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Marketing strategies for corn

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INTRODUCTION

"At the current prices for corn it would be wise to hedge for it is doubtful if this level of prices will hold." Suggestions like the above can sometimes be read in many farm publications. The puzzling element of the comment is just when to hedge. The person making the statement does not say whether to do it immediately, tomorrow, a week from now or when. Perhaps the price will fall, but perhaps equally likely the price will move higher. Perhaps there is good reason for its current strength. Oftentimes when there are strong upward surges in price, the market overreacts. The price rises beyond the equilibrium point and then sinks back. Is tomorrow, next week, or next month the best time to hedge? This study is an attempt to ascertain if the use of certain selected mechanical hedging strategies can be of benefit in placing hedges by producers and marketing firms.

Farmers are interested in selling at a high price. Marketing firms are interested in making a satisfactory or better margin on each sale. They want to capture the price rises and avoid the declines. Producers often argue that they combat the price variation by weekly or regular marketings. The optimum, however, would be lump-sum selling. Again the problem arises as to when would be the best time to market the product.

One finds that farmers and elevator operators are the actual losers if hedges are made at the wrong time as they own the commodities. If merchandising firms hedge and the price falls and the basis (the difference between cash and future) narrows they receive a profit or benefit from the hedge. What if the price rises? The operator makes a profit if the basis

pattern is as expected, but perhaps less than would have been attained if he were in an open position and prices rose. A method selecting between the two alternatives--remaining open or hedging--might improve the profit situation. Hedging strategies may provide possibilities to eliminate losses from remaining open and to refrain from hedging too quickly when it appears a hedge is worthy of consideration.

Merchandisers and producers are searching for methods of constant price protection. These individuals have continuous exposure to the market's fluctuations. Mechanical hedging strategies may offer some help. Subjectivity could possibly be reduced with these strategies. Of course, the decision variables in mechanical strategies are subjective but they can be held constant once established. The downfall of many operators is the sporadic, arbitrary involvement of the decision maker. There are a large number of trading strategies recommended by brokerage houses, but generally they are variations of the same few basic methods. The primary intent of this paper is to test the worthiness of various trading strategies and to sort out the better ones.

The use of hedging strategies may require that one be ready to remove a hedge already placed. It is often stated that once a hedge is placed, it should not be lifted. The reasoning is that the producer or merchant hedged in a profit at the time he made the transaction and he should stick with it rather than trading in and out of the market. This may have been a good rule of thumb or policy when prices fluctuated in a range of less than say ten cents for the year. However, it violates the opportunity cost concept which, next to the principle of marginality, is central to the theories of the firm and consumption. With the major bull markets of the

70's, why remain in a losing position? This concept of lifting a hedge and when to reenter a hedge again evolves around timing. Mechanical hedging strategies should suggest the proper decision as prices oftentimes follow patterns. Thus, the attempt is to capitalize on these price movements with mechanical hedging strategies.

STATEMENT OF THE PROBLEM

Grain producers are faced with a great deal of risk in the production and storage of commodities. Some of these risks are insurable. The emphasis of the decision maker after the commodity is harvested is on storing and marketing. Marketing has become a bigger factor for the farmer as loan programs are essentially eliminated and farmers control larger quantities of grain each year. Marketing is an aspect that can eliminate some grain producers from business if costs are high and they sell for $.50 to $1.00 less than other producers. Indeed, prices have recently fluctuated $1.50 on corn and as much as $7.00 on soybeans in the same year.

Hedging is a form of marketing insurance for the producer. Hedging solves some problems but creates others. Before dwelling on hedging, one should examine the relevant criteria a farmer should consider in making his marketing decision. First of all, what are his objectives? Are taxes or possibly limited storage space a restraint? There are a vast number of variables which enter into the decision making. To focus on marketing, assume there is no time or physical restraint. Then how should the producer value his grain at any moment in time? One school of thought evolves around production costs. This seems to be an inappropriate way of evaluating the grain as opportunity costs are not considered.

Another school of thought is the opportunity cost concept. What can the grain be sold for today? Just because one has an expensive method of production does not mean he will receive more money per bushel. The current local market price becomes the relevant standard.

By using the current market, the producer is faced with the same situation as the elevator operator. The one difference is the place of storage. Perhaps producers and elevator operators should calculate their carrying costs with the same objective. As price rises cause interest costs to increase, the decision maker must have expectations of a greater margin to induce storage. The producer and merchandising firm have for the most part the same set of costs. Some alternatives for disposing of the commodity would be as follows: (a) remain open and store, (b) hedge (short the futures, long the cash), (c) enter and exit from a hedge according to some trading plan, and (d) contract for delivery at a later date.

The first alternative is probably the one most used currently by producers. Upon surveying the price movements of the last two years, this might have been the most sound action in the recent past.

The second and third hedging plans are really rival theories. Hedging in practice is generally considered a fixed forward contract. Traditionally, once the decision maker took a position, he was expected to remain with it. This is the prevailing philosophy in the industry. If the operator employs a short hedge or selling hedge, he is protected against a price decline. However, there are a number of problems that can arise. Consider this. Should one maintain a hedge in a bull market?

Margin calls can be unhealthy for an ongoing concern with a short hedge in a bull market. This sometimes turns into unnecessary losses. Many operators are willing to accept a certain profit and be satisfied. However, until the recent past, they would have maintained their positions. Currently the atmosphere of the grain markets is one of wide price swings.

Of course, cash may be rising at a rate equivalent to futures. However, the point is that greater benefits may be available by reverting back to the first strategy--remaining open. One should liquidate his position if there is an overwhelming probability of price increasing and admit to bad judgment for acting prematurely. It is no crime to do so. This notion violates basic hedging theory according to traditionalists. Has the hedger become a speculator?

A hedger is a special type of speculator. For this study one normally thinks of speculation as taking positions in the futures market in hope for a profit without having a commitment in the cash. There is one difficulty with the above argument. In the real world, individuals sometimes are forced to maintain a hedge due to capital requirements. This is more true of elevator operators than farmers. Suppose an elevator has in storage 10,000 bushels of soybeans. Commercial banks will loan, say 60 percent of the value of the soybeans if in a cash position but, if hedged, will loan 85 percent. This requires less owner's equity. The trade-off is between the money needed for margin requirement and money needed to remain open. During a major bull market, one might be as well off to drop to the 60 percent loan rate. This initial investment to purchase the grain is fixed. When the value of soybeans rises, one will be able to obtain as many bushels in the open position as one could maintaining a hedge position. Hedgers are in both the cash and futures markets. They are speculating in the basis or the relationship between cash and futures. The hedger looks at a relationship, and the speculator looks at the price level.

The decision maker normally uses the basis as one of his primary tools. The basis has a historical pattern and demonstrates the same general movement each year. It is widest during the peak of the harvest and narrows during the rest of the season unless some unexpected event disturbs the market. The basis will be greater at higher prices than at lower prices due to the interest costs. What if the basis widens? In other words, what is a good hedge and why? These uncertainties are perplexing and the wrong decision can lead to devastating effects.

The major purpose of this investigation is to evaluate the strategy of entering and exiting from a hedge according to a trading plan. If the strategies are useful, which one provides the optimum results? There exists a considerable number of possible strategies. However, they boil down to several basic formats, each with several variations.

Another way to add support to moving in and out of the futures market rather than remain with a designated hedge is as follows: Hog producers who are "Inners-and-Outers", with proper timing, can attain higher profits than producers who are in constant production at a constant volume. A four to six year price cycle in hog production has existed since the 1860's. If one produces constantly, one is likely to suffer losses when the price has reached the bottom. When the price is at that point, one should be purchasing and breeding gilts. When the price reaches the top, and starts down, one should perhaps sell out. One should react in exactly the same manner when the price is at the low point again.

Moving to the last alternative of contracting for later delivery, one finds the decision maker in a rather inflexible position once the agreement is made. The physical commodity must be delivered by a

specified date if one is to fulfill his contract. In practice, some farmers contract a portion of their crop as soon as the price is high enough to cover production costs. Bad harvest conditions can create difficulties in filling the contract. When using futures for price protection one can trade in and out of the position. Oftentimes farmers look foolish after contracting when there is a tremendous price surge. Of course, delivery must be made if the contract is held until expiration.

Another disadvantage of contracting is that the contract is generally made on a basis which is greater than what is expected to exist at delivery. One should examine this carefully for this should be a major bargaining point. Maybe one should negotiate for a set basis rather than a fixed price. It seems that producers should seldom contract their whole crop as definite production uncertainties exist until the commodity is harvested. Contracting, however, offers the benefit of not requiring margin money and, hence, one is not faced with margin calls.

Many times contracting is a farmer's only protection if he is looking at forward price insurance by delivering. Farmers are not in a position to make delivery on a futures contract even if it is profitable. Also, they might not produce 5,000 bushels, the minimum quantity, which can be hedged. This is an institutional block to the farmer. Farmers generally do not have access to load-out facilities for railroad cars, let alone be able to obtain the cars after they are ordered.

Elevator operators have been caught in a similar squeeze recently with the shortage of railroad cars and the abundant harvests. If the elevator operator orders cars sporadically and does not have any leased

on a long term basis, he cannot expect to obtain the cars when he requests them. It seems nearly everyone desires them at the same time. The structure of the transportation industry has forced some elevators to truck their grain to terminal elevators rather than perhaps a point of export. The shortage of cars plus railroad abandonment has created some definite obstacles to hedging by a farmer. Pricing policies of the major grain firms have changed to take advantage of the car scarcity. If the local elevator has several cars available it can receive, say, five cents more per bushel than if the grain company purchasing the grain furnishes cars. The major firms generally have a railroad car fleet already under lease. These institutional factors have caused some drastic basis changes.

There are some real difficulties in hedging but also that is where considerable beauty exists under some circumstances. When one decides to hedge, perhaps he should record the reasons. Timing is the key no matter what strategy is chosen. Ideally, price movement should have reached its culmination before one makes his final judgment. Are conditions such that this action would be the most advantageous? This is difficult to ascertain, but one has to determine the relevant facts and weigh them in their proper perspective. For example, an elevator should survey the railroad car availability, the weather forecast, or the grain drying possibilities. One should not overlook the nearby obstacles before looking beyond. However, for the planning horizon, the decision maker must examine the overall picture and place it in its proper dimensions.

HEDGING IN THEORY

Formal hedging in commodities requires the use of futures. A futures contract is a forward contract. If one buys a contract, or is long, taking delivery becomes a possibility. Price rises offer a profit for "going long." When one sells a contract, or is short, delivering the commodity becomes a possibility. Price declines give the opportunity for a profit. The futures contract specifies the amount, the quality, the place of delivery, and the date when it must be in place. The only item that is negotiated is the price.

Hedging offers the opportunity for the owner of commodities to transfer some of the price level risks to speculators. Hedgers actually own the agricultural commodity or contemplate owning the commodity and transfer the price risk to the market. Speculators assume this price risk in hopes of a profit. They perform another important function of providing liquidity to the market by taking the opposite position of the hedgers. It should be noted that a hedge implies equal and opposite transactions in the cash and futures market or a futures transaction to accompany an anticipated need for the cash at some time in the future. One hedges under the assumption that the cash and futures price will come together at the date of expiration (if it is not a par delivery point it should only differ by transportation).

Cash and futures prices will be approximately equal at expiration of the futures contract because corn is a commodity harvested at one time during the year and delivery provisions provide arbitrage. It is gradually brought out of storage to meet domestic and foreign demand during

the rest of the year. In other words, the cash should rise continually until the next harvest under normal conditions. Over the years, five different months have become standardized by the industry as the contract months for corn. They are March, May, July, September, and December. These are the critical months in the crop year; for example, in December the harvest is completed.

There are long and short hedges. Each has definite applications. The long hedge would indicate a situation where the merchandiser or farmer has to procure the commodity to meet a future cash commitment (grain export, feed for hogs). The decision maker does not have the commodity for a number of reasons. Perhaps there is a desire not to tie up facilities and capital for an extended period of time. The hedge would be initiated when the future commitment was made. The operator would buy the option closest to the commitment he has sold in the cash. In practice, this is generally not handled this way due to the narrowing of the basis which either causes a loss or results in paying storage charges to some other merchant via the narrowing basis (a discussion of the basis will follow).

The long hedge does not apply to the heart of the issue that is being dealt with here for the major intent is to consider the situation facing the grain producer or elevator operator. The short hedge probably has more broad applications to farmers and marketing firms and it can be used more readily by the farmer or elevator. Most central Iowa operators and producers do not involve themselves with export dealings or feed contracting (in futures). The long hedge will not be considered further in this investigation.

The short hedge is more generally used. The situation of having to contend with price level risk on a stored inventory is frequent. Farmers and grain merchants seldom are without some commodity in storage.

The short hedge would be used when there is a commodity in storage. The elevator or farmer has the grain (either bought, raised or planned for production) so he is long the cash market. To offset the position in the cash, the operator would sell futures in the option closest to the time he expects to liquidate his cash position. This decision would be influenced by the carrying charge (explained later) which the various contracts offered.

In discussing hedging one would start with the "perfect hedge." The perfect hedge is usually a short hedge in textbooks. Suppose an individual owns 5,000 bushels of corn or enough for one futures contract on the Chicago Board of Trade. In order to protect himself from a price decline he hedges. On February 1 he decides to dispose of his cash grain in March, so the hedge is executed in March futures. He is long cash, thus he will go short futures. The transaction is shown below as A.

	CASH				FUTURES			
A.	Feb. 1	Buy	5000 bu.	$1.05	Feb. 1	Sell	5000 bu.	$1.25
B.	Mar. 15	Sell	5000 bu.	1.00	Mar. 15	Buy	5000 bu.	1.20
				$-.05				$+.05

Net Gain = 0 +.05 + (-.05)

On March 15 (B) he decides to sell his corn, so he buys back his futures contract. Did he lose because the cash price declines? No, because he had sold a future contract to guard against a price decline. One should note that if the price went up the same amount

in the cash and futures market, one would not be able to benefit from the price rise. The individual gained in the cash and lost in the futures. It is assumed that the cost of trading is zero. In reality there would be a brokerage fee plus interest on the margin money.

A change in the basis occurs when cash and futures do not change by an equal amount. The basis is defined as the difference between the current cash price and the current futures price. An unequal change exemplifies the typical situation. The following example illustrates a basis that narrowed:

	CASH				FUTURES				BASIS	
A.	Oct. 1	Buy	5000 Bu.	$ .95	Oct. 1	Sell	5000 bu.		$1.20	$ .25
B.	Dec. 1	Sell	5000 Bu.	1.02	Dec. 1	Buy	5000 bu.		1.18	.16
				$+.07					$+.02	$+.09

Net Gain = 9¢ = 7¢ + 2¢

In this situation the hedger captured a gain in both the cash and futures markets from the narrowing basis. This is not always the case. He may receive a profit overall, if the basis narrows, even though he may incur a loss in one market.

The next example is one of a widening basis on a short hedge. It is shown below.

	CASH				FUTURES				BASIS	
A.	Oct. 1	Buy	5000 bu.	$ .95	Oct. 1	Sell	5000 bu.		$1.15	$ .20
B.	Dec. 1	Sell	5000 bu.	.97	Dec. 1	Buy	5000 bu.		1.20	.23
				$+.02					$-.05	$-.03

Net Loss = 3¢ = -5¢ + 2¢

As one can see, the widening basis created a loss even though there was a gain in the cash market. Actual experience shows that one can profit in

one market and lose as an end result. It should be obvious that the net gain (loss) can be calculated two ways. The addition of the gains or losses in the cash and futures markets or the difference in the buying and selling basis. The following equations demonstrate this principle.

Net Gain (Loss) = Cash Gain (Loss) + Futures Gain (Loss)

Buying Basis = Cash Price_A - Futures Price_A

Selling Basis = Cash Price_B - Futures Price_B

Net Gain (Loss) = Buying - Selling Basis

The buying basis is the difference that exists between cash and futures when the hedge is initiated. The selling basis applies when one liquidates his hedge. The hedger attempts to maximize profits by having a larger buying basis than his selling basis. The bigger returns are derived when the difference is larger.

What should the basis be in a given geographical area? The basis for each geographic area is generally recurring and has a historical pattern. The basis may be described as representing the costs involved to store, handle, and transport the grain to or from delivery point of the futures contract, but this is not entirely true for basis changes. For this paper the delivery point is Chicago. Central Iowa would generally have a cash price discounted to the Chicago futures price. The basis for Baltimore or New Orleans would generally show cash above futures. The possibility of delivery is the factor which makes the grain market more perfect with respect to time. The basis may be above or below what actual expenses are making it more accurate to say that it is a market determined price for storage, handling and transportation services. Delivery becomes an attractive alternative when the basis exceeds the exact costs as an opportunity

for profit exists. This operation is what causes cash and future prices to typically converge during delivery months. The basis should differ by no more than transportation costs but it may be less. For example, an elevator company may need corn to meet the local demand for cattle feed in a certain area. Its bid price may suddenly increase (thereby narrowing the basis) in order to draw corn to its location. As one can see, local supply and demand conditions can have a substantial effect on the basis.

What other factors can cause the basis to widen or to narrow? These basis changes can be thought of as the demand for storage (46), the transportation available and the flow of cash grain into the market. A crop year with abundant production would make storage space scarce. Therefore, the elevator operator could widen his buying basis from what is considered "normal" or has been the historical average for the area. In other words, the manager would lower his bid price to producers so the basis would be 30 cents rather than 25 cents. A shortage of railroad cars or barges might cause the operators to widen the basis also. It should be noted that the operator would raise his bid price (narrows his basis) until he just fills his warehouse and transportation facilities. Otherwise he has lost an opportunity for a possible profit. This is difficult to project.

New crop bids by grain merchandisers are pure conjecture early in the crop year due to the uncertainty of growing conditions and export demand. The merchandiser would generally initiate his bids using the previous fall's basis minus a few cents. The few cents are to cover the uncertainty.

An astute producer, if he decides to contract his growing crop, will bargain on the basis and will contract his crop in this manner. The more narrow the basis is, the more the farmer receives. As the crop matures and the export demand solidifies, the elevator operator can more nearly estimate what the demand will be on his facilities and whether he will be able to move the grain. He then adjusts his bids to adequately reflect supply and demand conditions.

With more farmers increasing production and combining corn rather than storing in the ear, more storage and drying facilities are required for each year's harvest. The demand for storage has increased practically every year since the early 1960's. Many producers are relying on local elevators to handle this increased capacity. It seems that producers are erecting more storage and drying facilities on the farm. The strain on the elevator still exists due to the lack of railroad cars. Grain has to remain at the elevator longer. Normally, in central Iowa, grain merchants sell and remove many of their soybeans in the short period of time before the bulk of corn is delivered. The basis narrows rapidly on soybeans and more gradually on corn (5). With the present day transportation difficulties soybeans take up part of the corn space. One would do the opposite when cash is above futures. Again, this relation between cash and futures at the close of the option depends on the storage situation at the delivery point. The different options would generate prices higher than cash prices for they reflect the added costs of storage and handling. Under normal conditions one would think of cash rising to meet futures.

One term should be discussed before moving onto the next topic and

that is pre-hedging. This is the word that is sometimes used for initiating a hedge or selling futures without having the cash commodity. The Internal Revenue Service recognizes this as a hedge for a farmer when he has planted his crop. Otherwise, the elevator manager is involving himself in speculation, not hedging. The firm has taken an open position in the futures market. "Pre-hedging" happens mainly at times when there is a large influx of grain, say during the harvest. The grain company sells futures during the trading session in anticipation of what will be bought later in the day in the cash market.

Spreads, or the difference between two different options of the same or two different commodities, are pertinent to hedging. Of most importance is the difference between two different options. Spreading two different commodities is not of significance to a farmer or elevator operator. For example, a corn-wheat spread would offer little opportunity for improving the profit potential of the firm unless the firm desires to speculate.

The difference between options of the same commodity is defined as the carrying charges. Carrying charges are the costs involved in storage of the commodity from the expiration of the nearby option to the next option. These costs include storage costs, interest on the capital needed to buy the grain, and insurance.

How would one spread two options of corn? One must remember that the basis is of no significance in spreads. The transactions are shown below.

		MARCH CORN			MAY CORN	
A.	Feb. 1	Sell	$1.34	Buy	$1.34
B.	Feb. 25	Buy	1.30	Sell	1.35
			$+.04		$+.01

First one must assume that he is not facing the possibility of a market inversion. (A discussion of the inverted market will follow.) If the market indicates an intention to move towards full carrying charges, one would sell the near-by and buy the distant option. This would indicate the "normal" market. One would simply reverse his position to realize a gain as shown in the example. Much of the time the spread between options is less than carrying charges because if they reach the full amount spreaders buy the near-by and sell the distant. Enough people conduct this operation so that the difference between options is somewhat less than full carrying charges. The difference in price between options seldom is greater than carrying charges due to the number who will buy the near-by and sell the distant. This makes the market more perfect with respect to time.

What if the difference between options is substantially less than full carrying charges or at even money? There is no barrier as to how much the near-by can exceed the distant. This depicts the inverted market. The market is saying that it desires more grain now and is willing to pay a premium to bring it out of storage. This can be exemplified by an increase in export demand. Distant months will remain at a discount as long as there is increased demand or decreased supplies in the current situation. The distant futures will fluctuate little as compared to those close to expiration. Expectations are that the price will decline to the distant discounted prices once the need is filled for the current situation. The market then will reflect a premium for storing the commodity.

The inverted market presents a dilemma to a grain company. In this time of need for the commodity, one would buy futures and sell "to arrive" contracts. "To arrive" contracts are made by a firm that desires the

commodity and it will guarantee a given price if it is at a specified location by a designated time. The grain must be of a certain quality. The grain company would receive less for its commodity and have more expenses by waiting to sell the grain later.

Spreading is a handy tool to use in conjunction with hedging. Suppose the basis in October for the December option is wider than management's expectations. The merchant hedges by placing a hedge in the December option. When trading begins in later maturing options, the merchant decides to capture more profit by a further narrowing of the basis. After deciding which option offered greatest profit potential, the merchant spreads the December option and, say, the July option. When July approaches the hedge is closed. The following illustrates the hedge.

Cash		Futures		Basis
Oct. 1 Buy 5000 bu.	$1.50	Oct. 1 Sell 5000 bu. Dec.	$1.75	$ .25
Dec. 1	1.52	Dec. 1 Buy 5000 bu. Dec.	1.70	.18
	$+.02		$+.05	$+.07
Dec. 1	$1.52	Dec. 1 Sell 5000 bu. July	$1.85	$ .33
July 1 Sell 5000 bu.	1.75	July 1 Buy 5000 bu. July	1.87	.12
	$+.23		$-.02	$+.21

Net Proceeds from hedge = 28¢

As one can see, this hedge in wheat offers greater opportunities for profit due to the extra time for the basis to narrow. These transactions are known as moving the hedge forward. Seldom should the decision maker have to move the hedge forward. He should try to project the actual sale as accurately as possible for this last method often increases expenses.

One should now understand the theoretical construct of hedging. The futures contract, the basis and the spread are some of the key factors in making beneficial marketing decisions.

SURVEY OF RELATED STUDIES

Richard G. Heifner

Heifner (17) demonstrated in his investigation the effectiveness of hedging corn, oats, red wheat, white wheat, and soybeans in Michigan. His primary intent was to determine whether or not hedging reduced risk. The marketing years 1952 to 1963 were used. The cash grain prices of Michigan were coupled with the appropriate closes of the different futures contracts on the Chicago Board of Trade.

The time period of the investigation stretched from harvest to the next harvest with two month divisions for trading. The storage income strategies were executed the same way each year. These alternatives were compared to the income from remaining open. It was calculated by taking the cash price difference at harvest with the cash price at the end of the storage period. The income from hedging was the amount that the basis narrowed during the duration of the strategy. Interest, commission and margin were subtracted from the hedging income.

The two plans tested were as follows: (a) remaining in a cash position and (b) the returns from a short hedge placed in the option nearest to the corresponding selling date.

The results demonstrated that during the investigated period for corn and soybeans, high storage income one year was followed by menial revenue the next year. Corn produced the best returns due to price decline during the crop season. Red wheat, white wheat and soybeans donated small, if any, earnings from the short hedge. Bull markets persisted in these commodities. Oats provided profits when held until the latter portion of

the season. There was a recurrent pattern of a price rise during the first months of storage followed by a price decrease. Price movement patterns were tested statistically and proved to be seasonal and recurring.

When considering the risk level (comparing standard deviations) of hedging versus not hedging, there was a reduction in risk by hedging. In other words, hedging decreases the exposure to price changes. The variance in revenue derived from holding soybeans and red wheat was quite large. In contrast, corn and white wheat proved to have variances which were substantially narrower. Oats fell in between the two extremities but tended to be at the less volatile end of the spectrum.

The study further suggests that when hedging one should select a late season option when the selling date is not determined. The best approach when there exists a confirmed commitment for the cash grain is to hedge in the option nearest this date. These hedges showed less standard deviation than the situation where the selling date is not established. This trend, however, was negligible. The results illustrated that average revenues and the standard deviation of the revenues changed little from option to option. The basis narrowed substantially early in the season then approached a constant the remainder of the period.

In another study, Heifner (18) concentrated on the characteristics of the basis in Michigan for corn, soybeans and white wheat. The author developed a series of formulas for predicting the basis over different storage periods. Through these equations, he hypothesized that storage income could be increased by altering storage operations to coincide with the estimations. Different, overlapping time intervals were selected for comparison in each commodity.

Through use of regression analysis it was concluded that the basis decrease was much more predictable than cash price increase. Cash price increase from inception of the storage period to end of the storage period represented the control strategy in the investigation. There were only two times cash price was estimated with greater accuracy than the basis for the three commodities. In addition, variance of the basis was less than the basis for cash prices. The corn basis proved to be more precisely projected than the basis for white wheat and soybeans from year to year.

White wheat exhibited a predictable pattern through December. Basis change estimates over August 15 to October 15 interval were a failure. The estimations for the time period extending into February and April fared somewhat better but not substantially. The soybean basis was well explained by the model for periods terminating in April.

In the second division of the investigation, the predicting model was employed in decision making for storage of the chosen commodities. Four variable storage cost levels were considered ranging from zero to three cents per bushel per month. This reflects the economies to scale of different operations. The conditional storage rule was contrasted with storing each year no matter what conditions prevailed. The storage rule was simply that if the predicted revenue exceeded costs at the start, then the grain was warehoused during that time interval. If results displayed a loss, then the grain was not stored.

Firms with lower costs naturally would find it beneficial to store grain when firms with less efficient facilities had to sell the commodity. Employing the conditional storage rule, average income was increased while

costs connected with warehousing declined. Price levels do affect the decision making as they tend to increase storage costs.

During the early part of the crop season, storage revenue exceeded variable costs nearly every year for every size firm. The decision rule was of little significance. The intervals were 11/15 to 1/15 for corn, 8/15 to 10/15 for white wheat and 10/30 to 12/31 for soybeans.

The duration following the first designated period required the storage rule. Firms with a one cent storage cost for corn could find the rule beneficial in January when faced with the prospect of further storage. The study suggested average storage revenue could be improved by three fourths of a cent per bushel over time while reducing costs at the same instant. October and February were the turning points for white wheat and soybeans, respectively. For these two commodities long run benefits may exceed one cent per bushel by use of the rule.

In summary the crop season can be divided into three parts. The first section is after harvest when it is nearly always profitable to store. In the second division income approximates the variable costs. In the third section chances for benefits are about equal to losses. In other words, it is a remarkable year when it is worthwhile to warehouse grain for the entire season.

R. W. Wisner

Wisner (41) suggests seven preliminary steps before the decision maker hedges. They are as follows:

1. Adapt the futures price to the local area
2. Estimate the probable size of later cash transaction
3. Determine the possible returns with a hedge
4. Survey all the sources of market information especially those pertaining to the future situation

5. Calculate the benefits without hedging
6. Compare the returns with and without hedging, and analyze one's risk preference
7. Choose the best alternative

One must subtract four things to localize the price (Step 1). First is the normal basis. The second is the quality differential (No. 1 vs. No. 2) for it may not coincide with the specifications for a futures contract. The last two items to subtract are interest and the brokerage fees. This provides the decision process for the operator.

Gerald Gold

Gold (12) pointed out some aspects of the grain market which were not mentioned earlier. It should be evident that spot (cash) prices and future prices of various options do not move up and down by the same amount. One can easily find examples of near-by options rising and distant ones declining or vice versa. At the same time there are price changes among different grades of cash. Sometimes one will find one grade discounted more than at other times. Due to the inflexibility in the size of the futures contract, price changes may not exactly reflect the change of value in the hedger's inventory. Actual experience shows that this is a common happening. Hedging offers an opportunity to set a price on a processed product like flour by using wheat futures. This makes hedging a useful tool over a more broad spectrum but this is not the concern of this investigation.

Gold mentions one other idea which might be beneficial in strategy formulation. In an inverted market, futures will show more price strength than is found in the cash market over time. Cash and futures must approach each other at maturity. The discounted distant options remain at their levels while the cash drops to meet the futures.

T. A. Hieronymus

Hieronymus (20) names four principal ways which farmers can use futures to market grain. First, to determine a price before harvest. Second, to fix storage income on grain for later delivery. Third, to lock-in feed costs without taking delivery. Finally, to speculate in the price of grain which had to be sold due to lack of storage space. The last two alternatives can be eliminated. The third because it involves a long hedge, and the fourth for it pertains strictly to speculation. The first two notions summarize two of the major intents of this research. In essence, the main motive is to enable the farmer to realize a greater value for his commodity. The author claims that inventory owners are speculators. The farmers turn out to be the primary group in this area.

Hieronymus points out that typically at the expiration of an option the cash price exceeds the futures price. This is not a violation of theory. The handling charges and quality difference create this aberration. His investigation of the basis for corn, soybeans, oats, and wheat covered the years from 1955 to 1961. The week to week cash prices were compared to two options of futures depending on the commodity. The options were chosen so to maintain a hedge year round.

During the seven years studied by Hieronymus the cash price for corn tended to rise during the crop season. The average price increase from mid October to July was twenty cents per bushel. Cash and futures prices move in the same direction but not by equal amounts. This accounts for the narrowing of the basis. To bring these two facts together, if all buyers and sellers are well aware of the supply and demand situations from the

beginning of the season with no change then the average variation for futures prices would tend to be zero. This would be true for any commodity.

The characteristic corn basis shrank seven cents from planting to harvest. It increased about five cents from harvest to spring or summer. The average yield increased each year which may be the compensating factor for the variation being greater than zero. As the yield increase became known the price tended to decline each year. Expectations during the first part of the season were the same yield as the previous year.

He observes that the basis charts for the period are all rather similar. The general form for each shows cash prices rising relative to futures with stabilization during spring and summer. December and July options were utilized for corn. The difference between these two options remained constant. It differed more than one cent from the average of eleven cents only one time.

Hieronymus also points out that the December basis at harvest fell about ten cents. Each demonstrated some significant differences, especially at harvest, when the July basis ranged from fifteen to twenty-five cents. Nineteen cents was the average basis for July at harvest.

The basis during the time period prior to harvest is strictly conjecture. The basis is founded on expectations of what the crop may be. This explains the volatility of the basis from year to year also. It should be noted that grain merchants are interested in the relationship of cash to futures. When they believe the basis is distorted, merchants buy cash grain and sell futures. If the basis differs from harvest time, grain merchants have miscalculated the actual conditions.

Hieronymus states that storage is fixed for any one crop year. The basis should reflect the costs involved in holding the grain for a specified period of time. When faced with a short crop, operators will accept a smaller basis and not cover full costs rather than have the facilities remain empty.

Weather conditions at harvest may cause the basis to widen. Corn with a high moisture content cannot be stored easily unless there are drying facilities or it is fed to livestock. Most producers cannot dry the corn as fast as it is combined so it is hauled to the local elevator. Even in a short crop year it places an unforeseen stress on facilities similar to a large crop.

He notes that the Chicago basis is generally widest when the crop is finally harvested or approximately December 1. The basis during July or the end of the storage season is fairly constant. The basis tends to vary with the supply and demand conditions at Chicago (par delivery point). If Chicago is lacking corn the basis could grow to reflect transportation costs. This would attract delivery to Chicago. If stocks in Chicago are sufficient then the basis would tend to narrow.

Hieronymus (20) used a "target price" technique where one establishes the price he hopes to receive by subtracting the average basis for a particular location from the time in question. In this instance the time is harvest. This translates the futures price to a cash price. If the farmer hedges, before planting (on May 2 for corn), he can set the cash price within a fairly narrow range of what he will actually receive at harvest. The hedge is terminated on October 17. Over the period from 1955 to 1961 the hedge lost three times and registered a profit four times

when comparing the results to the target price. The range from the target price minus four and one-fourth to a positive four and one-eighth cents. These were narrow misses of the estimated price and gave the farmer a method to make judgment on what he will receive.

The average harvest basis in this example was eighteen cents. If December futures were selling for $1.50 on May 2, then it would be translated into a harvest cash price of $1.38. This is what the market is predicting considering the current situation. The market is also guaranteeing the producer at least $1.50 if the grain is delivered to Chicago. If the farmer concludes that this is an adequate price he sells futures. Assume that by December the futures have declined to $1.40 with a local cash price of $1.19. With the ten cents profit in the futures he receives $1.29 or on 5,000 bushels $500.00 more than remaining open. Commission and interest need to be subtracted to obtain the net gain.

With the fixed liquidation date it is difficult to attain the target price. If it was variable, with liquidation occurring when the basis is 18 cents, profits would be improved.

According to the results it was profitable to exercise this method each year. However, increasing production existed each season. In the long run, profits would probably equal losses. If the producer includes his judgment in decision making he may find this procedure meaningful.

Hieronymus analyzes the farmer's situation. He faces two courses of action at planting--contracting or hedging in futures. Hedging offers a higher average forward price (the farmer has the full advantage of basis

change) and more flexibility. Say the basis falls to twelve cents due to growing conditions. He may, prior to harvest, close out his futures contract and be long cash. If price rises and the farmer contracted he cannot get out of his position as easily. Contracting benefits the farmer in these ways--a fixed price, no margin money, and less than 5000 bushel lots. This example illustrates the idea of the "blind hedge" at planting which proved to be of little benefit.

Hieronymus considers another aspect of value to the farmer. It is establishing storage income. The "target price" technique is employed again. The normal basis at delivery for the latter part of the season for East Central Illinois averaged eight cents for years involved in this investigation. The storage interval began on October 17 and finished on July 1 of the same crop season. If the farmer was content with the derived cash price he sold as much corn on the futures as was in storage. On July 1 he sold cash grain and covered his short position.

The deviation from the projected price for corn ranged from $.04 7/8 below to $.03 above. As one can see, the basis forecast was fairly close even though price levels changed drastically as in the case of soybeans. Corn was on the plus side of the forecast twice, broke even once, and demonstrated a minus outcome four times.

Again the farmer must contemplate what the local elevator will pay at completion of the time period considered. For the most part it is speculation.

This technique offers producers an opportunity to profit from storing grain on their premises. If at harvest the farmer decides the price is adequate and he is pessimistic toward price increases, should he sell his

corn? He will not attain any earnings from his storage facilities until the crop is harvested again. This method allows him to receive the price he desired plus storage income. If the producer sells his grain it is final and leaves him inflexible. In other words, by using futures the decision maker can change his mind if there is a substantial change in the basic supply or demand situation.

The study went further to combine the planting and the harvest hedges. December futures were sold at planting, lifted and the hedge reestablished in the July contract after August 1 and before November 14 of the current growing season whenever the spread was ten cents. If ten cents was not attained the hedge was forwarded to July on November 14. When the July basis reached eight cents the short position was covered and the cash grain was sold. The final date for closing the transaction was July 3.

The results, when comparing final price to the basis projection, gave an actual price to be above that from the basis projection four times, below twice and equal once. They ranged from a profit of one and one-half cents to a loss of two and five-eighths cents. One would conclude from examining the results that over time returns would equate to the exact target price. Deviations from the target can be explained by having to be satisfied with less than a ten cent spread between December and July 1 and having to close at less than eight cents basis in July. Hieronymus further suggests that these aberrations might have been reduced if daily prices were used rather than weekly prices. This could explain misses throughout the entire study.

Hieronymus (19) proposed a thought which startled many but is very significant. His claim is that hedging should be defined as speculating

on the basis. By hedging, one transfers the risk from a cash position to a basis position. This attitude is difficult for some to cope with but it does deserve some thought. He mentions that the width of the basis should be considered the demand for storage. In big crop years it will be greater than during seasons of low production. The basis is the widest at harvest. It narrows rapidly as stored grain begins to be sold. The writer explains that apreads are determined by the situation at the delivery point. This phenomena determines whether or not the market pays full carrying charges. During years of little off-farm movement of grain the basis tends to be more narrow. When the producers sell at harvest it seems to be wider.

Hieronymus compared cash market relationships. He noted that Omaha and Kansas City cash corn began at premiums to Chicago cash corn and ended the seasons at discounts. He concluded the reason for the relationship change was the CCC corn movement during the period studied.

Virgil A. Wiese

Wiese (Chicago Board of Trade, 5) presented a fascinating merchandising strategy for the grain storage business. He explained that for elevators in his area corn and soybeans were the major products. Soybean harvest on the whole was usually complete thirty days before the major influx of corn. His firm started moving soybeans out of their facilities rather quickly for most of the merchandising margin (basis change) was gained in that short period. The elevator would then prepare for incoming corn because the return was greater over time for storage of corn than soybeans because they could capture another rapid basis improvement. Other producing areas might have shorter or longer storage periods for

soybeans. He mentions that elevator operators would only hedge in November soybeans if they contracted with producers in late summer. Some elevators get high utilization of storage space if they are in the proper location. Wiese reports that in areas where wheat is also grown it should be liquidated in October to prepare for soybeans. Thus, there is triple use of storage space and a capturing of three rapid basis changes. In general, an elevator operator should attempt to purchase corn at the pinnacle of harvest.

When placing a hedge at harvest, Wiese recommends avoiding the inverse markets. For example, if May wheat is selling at a discount to March, it would be best to hedge in March. If there is an adequate reflection of carrying charges in the market (May above March), one would use the faraway option. One may even consider July in corn.

Truman F. Graf

Graf (15) investigated hedging during 1949 through 1951, a period of war and peace. He evaluated cash and futures for four, eight, and sixteen week periods. Data for the study were based on each week's Friday closes of futures and cash (sometimes nominal) from the Chicago Board of Trade. He surveyed corn, wheat and oats. Soybeans were omitted due to lack of cash quotations and because they were thought to be too speculative. The two major thrusts of the study were (a) an analysis of the desire for hedging and (b) an analysis of the effectiveness of hedging.

Hedges were placed in the near-by option where there were eight weeks prevailing prior to expiration. For example, an elevator operator on April 8, 1950 would hedge in July corn rather than May corn.

Graf first studied cash price variability. He discovered that corn

price changes of $.10 or greater occurred 13 percent of the time during the four week time periods, 28 percent for eight week periods and 34 percent on sixteen week periods. Of these changes, the price increased 59 percent of the time during the four week intervals, 62 percent during the eight week periods and 73 percent over sixteen week periods. If a going concern had remained in a cash position at all times it would have benefited for the most part. However, losses might have taken place at the same time which would have caused the firm to go under.

Graf (15) considered the effectiveness of hedging. The effectiveness was determined by the monetary outcome of short basis hedgers (sell cash - buy futures) and long basis hedgers (buy cash - sell futures). By his definition the effectiveness of hedges should reduce profits as well as losses to long basis hedgers. If benefits to long basis hedgers had not declined, then short basis hedgers were left vulnerable. When the long basis hedger gained, the short basis hedger would lose and vice versa. If a grain merchant remained in a cash position, his losses or gains would equal cash price change. Assume cash price fell ten cents. Had he hedged his loss would be two cents and the hedger would be considered 80 percent effective. A four cent loss produces 60 percent effectiveness. To further designate effectiveness, long and short basis hedgers must be researched. While cash price declined, futures remained constant. For the short basis hedger, it constituted a ten cent profit. The long basis hedger was hit with a 10 cent loss. This hedge was not effective at all as neither benefited (as measured by how much profits were reduced or increased). To have 100 percent effectiveness, the long and short hedgers should not receive a gain or a loss.

Results of effectiveness of corn hedging during the three-year period illustrated it was effective approximately 27 percent of the time. Each year was separated into quarters. The July-August interval in 1950 proved to be disastrously ineffective which lowered the average significantly. The May-June quarter displayed the most consistent effectiveness. Hedging effectiveness increased with a reduction in price support activity.

The number of hedges during the three year period with a high degree of effectiveness increased from 1949 to 1951. The average effectiveness of the hedges remained the same. This indicates that ineffectiveness of of ineffective hedges apparently declined rather than hedging effectiveness climbing. Of the hedges in the study only 70 percent were effective in 1951 but one-fourth of these were less than 50 percent effective.

Graf concluded that hedges were effective when they needed to be (big cash price moves) and ineffective for small moves. He noted that the net profit margin for elevators in 1939 was 1.33 percent of sales for small grains. Corn price decreases of 2.63 percent were not removed even with effective hedges. The price change not covered by hedging averaged 3.33 percent. In both these cases it exceeds the 1939 benchmark substantially.

In summary he suggested that hedging is imperative as nearly 40 percent of the time during eight week periods for 1949-51 price declined for corn, wheat and oats an average of over seven cents. A firm cannot incur losses of this magnitude for long without compensating price risk. He points out that cash price decreases and futures price increases happened more often than futures declines coupled with cash price increases.

Overall the cash price change as a percent produced a mean of 5.2 percent for the three years. Hedging eliminated 1.8 percent for the three

gains leaving 3.4 percent unprotected price risk. The effectiveness of the hedges during the major swings compensated for these figures.

When the decision maker (long basis hedger) was faced with a large negative basis (futures under cash), he incurred larger losses gaining little insurance from price risk. The greater the basis the less effective the hedge. In general, it was best to hedge in the near-by or second near-by options only if futures were not greater than cash by more than five cents at the initiation of the hedge. If these barriers were established 53 percent of the price change risk was eliminated. When futures were over five cents in either direction from cash it was best not to hedge.

Holbrook Working

Working (47) analyzed the price of storage by studying the inter-temporal price relations. This relationship is defined as a comparison of prices which are applicable to different times. It may refer to the relation of a spot to a futures price or between two forward prices of the same commodity. An example would be May and July corn.

He suggested that for commodities which are harvested at one time a profit is needed for it to be stored for later use. He states that the difference between prices for two different delivery dates for one commodity reflects the cost of storage. When abundant supplies exist December wheat can be expected to be above May wheat by carrying costs.

Storage costs are competitively established. Supply and demand will dictate the charges. Bumper crops will dictate the costs of storage to be above actual cost. Scarcity will induce a less than actual storage cost situation. Elevators were pitted against each other for available grain in both situations. However, competition was much more fierce during a

sparse crop causing decision makers to raise cash bids in order to fill their facilities. Inter-temporal price relation explains price behavior.

At this point only a positive relationship has been considered. An occurrence where the faraway futures option is below the price of the near-by option in the same crop year signifies negative storage income. In other words, the market is wanting the grain to come out of storage.

Two fallacies to the price of storage theory are mentioned. They are as follows: (1) Many who own facilities store grain and do not make decisions on the basis of the inter-temporal price relation, and (2) decision makers who hedge may not recover earnings equivalent to storage costs. Translating these two ideas into different terms, one sees the first referring to individuals who plan activities without looking at prices. The second alludes to those whose expectations overshadow actuality.

In another study, Working (47) investigated the effectiveness of hedging using wheat futures. He first explores the use of futures by a processor. His concern was not storage income but manufacturing profit. In fact, little effort is made to ascertain storage earnings. The futures represent a substitute for a cash transaction while at the same time locking in material costs. It also allows the processing plant to continually function as this is a method of attaining raw materials and pricing the processed product.

Hedging provides the mill operator an opportunity to project his manufacturing margin by locking in returns from by-products and by locking in cost of raw material. The last item makes up the majority of the costs. The main point is that forward contracts can be used to establish prices for final products at the same time as raw material costs are established

lessening the possibility of losses. In essence it reduces risk. The decision maker can exercise more freedom in taking action and be more competitive in bidding at the marketplace.

George E. Kreis

Kreis (26) researched three different hedging operations feasible for country grain elevators in Iowa. These operations were compared to remaining in an open market position. The study covered corn and soybean prices from October 1, 1963 to October 1, 1968. Storage periods of 15, 30, 60, 120, and 150 days were considered. Chicago Board of Trade futures prices were paired with cash grain prices offered to elevators in Central Iowa as a foundation for the study. Each option was tested for its hedging profitability.

The first and most widely employed hedging operation discussed was a short futures position coupled with purchased grain. A buying basis (futures minus cash on the day of purchase) was computed and subtracted from the selling basis (futures minus cash on the day of selling). The initial basis represented the potential income. The hedging operation was pitted against the gains in the cash. The analysis included varying the lengths of storage over the five years also. The benefits of both methods were formulated into weekly averages for the final comparison. The five corn and seven soybean options were used in the hedging portion.

The second hedging operation investigated was a buying hedge. Elevator operators would take a long position in the futures market to offset a forward commitment in the cash market to another merchandiser. A basis was calculated on the day the sale was confirmed. The basis on the day

the cash was purchased was derived and subtracted from the first basis to generate the possible benefits.

The final hedging strategy involves a spread. The warehouseman buys the near-by option and sells the faraway. When the cash grain is purchased, he sells the near-by contract. He has established his cash grain price and locked in storage income for the future. Hieronymus (20) recommended January and May options for soybeans. December and July options are best for corn. The profits would be computed by adding the difference of the cash prices, (buying time and selling) the near-by futures prices (price when the spread began minus the futures price at purchase of cash), and the faraway futures prices (price when the spread began minus futures price at cash grain sale date).

Kreis concluded that for corn storage for the five year period the average gross storage income was higher when comparing hedging to not hedging and demonstrated more consistency in earnings (lower standard deviation). The last two crop seasons (66-67 and 67-68) proved to be the most beneficial years to hedge as the basis followed the predictions of theory very closely.

Surveying the benefits of storing corn over time one discovers in general that as days of storage are increased the number of profitable weeks of storage declines. It varied immensely from year to year.

The buying hedge for corn gave rather unpredictable earnings (losses). Intermittent checks point out that selling "to arrive" provides less income than grain storage. This hedging operation was quite beneficial at times. The data were not as extensive for this strategy as for the others.

Using the spread that later developed into a hedge was beneficial for the warehouseman. The conclusions were founded on spot checks. This hedging operation depended on the basis in December and July and whether or not the difference between the two options reflected full carrying charges.

Soybeans displayed less profit opportunities than corn from hedging. The selling hedge reduced gross mean earnings but generated a lower standard deviation than remaining in the cash. This trend was exhibited on the shorter storage lengths. Elevators could realize a greater return by storing corn than soybeans. Earnings ranged from substantial profits to disasterous losses.

The second hedging operation (the buying hedge) apparently provided a stable trend as one of its merits. The spread showed the most consistent results. Profits were derived all five of the years investigated. The warehouseman should examine the possibilities of this alternative for better returns in the future.

Kreis recommended that one might maximize earnings from corn storage by turning the inventory often rather than keeping the initial purchase for a long period of time. He contended that four bushels of corn each held for 15 days might give a higher total gross income than storing one bushel for 60 days. The quick turnover generates greater costs in commissions and handling which would balance the two alternatives. Storage earnings from soybeans follows a similar pattern.

Kreis strongly suggested that grain merchandisers should concentrate on the basis. The decision maker should review the historical pattern and the relation of the current basis to the mean.

When faced with an exceptionally wide basis the hedger should review similar situations of the past. When favorable basis changes are anticipated one should hedge. Otherwise, the hedger should remain open. The author noted that although a hedge reduces risk it does not guarantee profits. The basis may not change at all during the entire length of storage.

Henry H. Schaefer

Schaefer (34) researched the basis of live cattle and live hog futures. In addition, he analyzed several hedging strategies and compared them to not hedging. The investigation covered the period from 1964 to 1972. Live cattle and hog futures on the Chicago Mercantile Exchange were compared to cash price for steers at Omana and butchers at the Chicago-Peoria terminal.

Schaefer found that the basis did not demonstrate a recurring pattern for either hogs or cattle as occurs in grain. It was found that the cattle basis reached its lows in August and October. The highs were attained in February and December. Furthermore, the October basis tended to decrease and approach zero on the final day of trading.

The basis for hogs proved to be at its low during the August and October options. The December option produced the widest basis. The June option had the most pronounced peak. The June option was the only one which consistently approached zero at expiration.

Schaefer's hedging plans consisted of two naive and three selected strategies. The naive methods consisted of (1) not hedging and (2) always hedging. Always hedging is interpreted as a hedge placed on the same day as the cash purchase or sale. The selected strategies were (3) a

futures-forecasted cash price, (4) a Bayesian forecasting model, and (5) a ten-day moving average.

The first selected strategy required a forecasting model to project a cash price fot the potential sale date for the finished livestock. If the forecasted cash price was exceeded by the target price a hedge was placed. The target price is derived by subtracting a constant for location from the futures. The constant puts the futures price into meaningful terms for the producer.

Bayesian decision theory allows one to consider a vast number of possibilities. No data are required for this plan. Probabilities are estimated by the decision maker for the possible states of nature. The objectives of the decision maker are needed as well as the possible payoff of each alternative.

The appropriate decision is chosen by multiplying the probabilities and the payoff schedule and then summing over each action. The total is an expected payoff. After the decision maker has reviewed his objectives the strategy which gives the highest payoff is selected. The ten-day moving average is the same as the one used in the author's investigation. It is a mechanical trading strategy developed by Keltner (24). Reviewing the trading system, one first averages the high, low and close for the ten days prior to the current session. These daily means are averaged over the ten-day period to give one composite mean. The daily range (high-low) is averaged also. The buying price is determined by adding the average daily range to the ten-day average. The selling price is found by subtracting the daily range from the ten-day average.

Schaefer tested these hedging strategies over several feeding systems

which closely resembled those in practice. There were three systems each for cattle and hog producers. The first system for cattle was placing 400-pound steer calves on feed November 15. They were sold on August 15 with an estimated weight of 1,100 pounds with the grade of choice. The second feeding operation began on January 1 with 600-pound yearling steers. These were fed until June 15 to approximately 1,100 pounds. The third system involved 600-pound steers bought on April 15 and put on pasture for the summer. At summer's end the steers were moved to the feedlot with marketing time to be December 15. Approximate weight was 1,100 pounds.

The first hog feeding system involved placing 40-pound feeder pigs on feed on July 1 and selling October 15. The second system had a starting time of September 1 with a marketing date of December 15. The final hog feeding plan used the period from January 1 to April 15 with April 15 as liquidation date. Hogs were finished to an estimated weight of 220 pounds.

One remaining aspect of hedging is considered in this study. Delivery was always a real alternative as producers can easily deliver livestock against futures. The net prices from delivering and selling locally are compared.

Surveying the results of the two naive strategies for cattle, Schaefer found that remaining in a cash position yielded a higher net mean price. The difference of the two plans during the November-August system equaled $2.91. The remainder for the January-July was $1.97. The April-December period was the least with $.60. The variance was always greater for remaining open than hedging. Only seven times during the periods investigated did the hedged position generate a greater return. The hedged position always produced larger net gains when the cash price decreased

during the feeding period. It was generally better to liquidate the hedged position than to deliver.

Looking at the results of the futures-forecasted cash price, one finds that for the entire time period of three feeding plans, there were only seven hedges. The remaining time periods no hedges were placed. In every situation where the plan indicated a hedge it yielded a higher net price than not hedging and vice versa. Overall, the mean net price for the strategy was $.09 higher than the results of the constant cash position and $3.00 above continuous hedging. The variance, however, landed between the variances for the cash position and the complete hedge. It was concluded that this selected hedging strategy, the futures-forecasted cash price excelled the two naive strategies.

Moving to the Bayesian strategy, the results simply provided further justification to the first selected strategy, the futures-forecasted cash price. The results were identical.

The ten-day moving average involved a number of transactions during the feeding periods. However, 45 percent of the time the feeder was in a cash position at the termination of the feeding period. Delivery possibilities were eliminated. This selected hedging plan produced a net price greater than the net price of a complete hedging. For the January-June period, the net hedging price exceeded that of remaining open. The cash position for the other two feeding periods returned a higher mean net than the ten-day moving average. The average hedging cost increased drastically for this trading system. The ten-day moving average mean net price and the variance fell between the two naive strategies two of the three feeding periods. The net price for the January-June period excelled the cash

return by one cent. The April-December variance rose above the cash position by 39 cents.

Only once, considering the three feeding systems for all strategies, was it unnecessary to deposit more margin. Forty-five percent of the time the feeder needed twice the initial margin. Forty-one percent of the time total margin requirements reached three times the initial margin. Additional capital is definitely needed to hedge. Less margin was needed with the first two selected hedging strategies.

Schaefer (34) found that two of the three hog feeding systems generated a higher mean net price for not hedging. The January-April feeding period produced a net price $.40 higher by hedging. The open position proved to be $.39 higher for the July-October period and $1.55 higher for the September-December period. The variance was less for hedging except for the January-April system. One can see that a higher net mean price gave a larger variance. Routine hedging failed to guard the hog feeder against a price decline as well as it did the cattle feeder. When liquidating it was generally more profitable to deliver.

Examining the results of the futures-forecasted cash price plan, we see there were only six hedges. There was delivery in four of these cases. This strategy fell short of the cattle results. Twenty-five percent of the time it indicated the wrong action. This trading plan provided a higher net mean price than routine hedging in every case. The gain ranged from $.50 to $1.45. When compared to remaining open, the selected strategy produced a greater return in two of the three hog feeding systems. The September-December cash position was above the futures-forecasted cash price plan. The variance of this selected

hedging system fell between the variances of the hedged and nonhedged positions.

The Bayesian strategy produced identical results to the first selected strategy for hogs just like in cattle. The ten-day moving average hedging plan tended to have outcome characteristics similar to cattle. Hedges were placed and lifted a number of times. The hog feeder was in a cash position 47 percent of the time at liquidation. This situation eliminated the possibility of delivery.

The ten-day moving average mechanical hedging operation returned a higher net mean price than either of the naive strategies except for the September-December period. The first two selected strategies exceeded this mechanical plan on the average for all feeding systems in the studied period. The variance was rather volatile ranging from the second smallest to second largest of all strategies for all cases. Average hedging costs were much greater than those of any of the other strategies.

The capital needed for hedging hogs tended to be less than required for hedging cattle. In twenty percent of the cases only initial margin was needed to maintain the routine hedge. Twenty percent of the time, however, three times the initial margin was required to maintain a hedged position. The average maximum investment declined when employing the futures-forecasted price and Bayesian plans. Many times no hedges were placed. The ten-day moving average strategy required that additional margin be deposited only once. The additional amount totaled $52.00. Otherwise initial margin was sufficient.

PROCEDURE

The objective of this investigation is to evaluate alternative decision rules for marketing grain with emphasis on use of futures markets for hedging purposes. The outcome of these rules will be compared to several strategies for marketing corn at given times. Also, comparisons will be made with recommendations made in extension outlook newsletters and farm periodicals.

Futures price charts are widely used for speculative and hedging trades in the grain industry. The most common types of charts are the (a) bar and (b) point and figure charts. Bar chart followers recognize certain patterns and formations which they believe to be signaling market events. A certain "feel" for the market is required to interpret these charts and interpretation still relies to some extent on subjectivity. Point and figure charts have more definite rules for entering and leaving the market. Some traders rely entirely on charts and some use a combination of charts and conventional fundamental analysis. It should be noted that with either type of chart the usefulness varies considerably from commodity to commodity. Certain formations for soybeans are generally believed to occur more frequently and are thought to have more prediction reliability than the same patterns for live cattle. One simply needs to be aware of these idiosyncrasies for each individual commodity.

The foundation of this study is the cash and futures prices. Futures prices (open, high, low, close) were gathered through the help of Continental Grain Company (9) providing a computer tape of some of the price series with the remainder coming from the Wall Street Journal (10). The

corn futures on the Chicago Board of Trade are most generally used by producers and grain companies of the area. The cash prices came from the Des Moines Register and Tribune (4). They are bids to farmers by central Iowa elevators. The cash price was reported in a range so the midpoint was chosen to facilitate calculations. The set of prices employed in this study start on January 2, 1962 and end on December 31, 1973.

The cash price is one that producers face. Local grain companies are quoted a higher price when they merchandise the grain. In order for warehousemen to realize the benefits of these strategies they must add the average margin per bushel of corn to the cash prices used here.

Several assumptions need to be designated at this point. Carrying costs (interest, insurance and storage) fluctuated widely during the period of consideration. They were fairly stable until the late 1960's and 70's. With huge exports, disastrous harvest conditions, high interest rates, railroad car shortage plus the energy crisis during the 1970's, carrying charges skyrocketed to unbelievable levels. As the price of grain rises so does this cost. In addition to the high price of grain, interest rates have also risen to new levels in the recent past. For the most part, there were few wide aberrations in the interest rate during the 1960's. Therefore, the carrying costs for most of the 1960's were stable. These costs are incorporated into the models for the entire period. An eight percent rate of interest persisted for most of the period. This rate will be used for this study. Admittedly, the rate was higher and lower than the one chosen, but the author feels the rate is indicative of the normal situation for the period.

The initial margin varied with the volatility of the market. As prices jumped so did the initial margin. Of course the hedging margin is lower than the initial margin required by speculators. These two margins are directly related and moved in unison in either direction. The exact hedging margins required of the standard 5000 bushel contract over the designated time period can be found in the Appendix (Table A1). The exact hedging margin was used and was maintained daily. If profits were accrued, it was withdrawn and invested at a rate of eight percent. The opposite takes place when losses occur. Interest costs are an important factor in futures market operations as it is assumed that the margin money is a loan. If this be so then one must look at opportunity costs. By switching the margin requirements and carrying costs continuously to reflect reality throughout the investigated period would complicate the simulation. The results can be easily adjusted for these deviations.

The commission is always deducted in futures trading at the termination of the transaction. It is subtracted from the remaining margin. The commission has risen over the time period being considered. The rate in the simulation model will change to reflect the changes. The amount paid for commission could arise to be a major factor in some of the trading plans as they require a number of entries and exits.

A major assumption which is imperative to the whole study is that market orders, as designated by the models, are executable at that price or in the near vicinity. It is difficult to replicate actuality in these circumstances. It requires personal judgment that a computer cannot donate. The most delicate event to program is transaction execution during

a limit move. Often when the market surges and one is in a losing position, it can be several trading sessions before one can close out the position.

It may be advantageous to develop strategies for the two different situations that have existed in the corn market during this study in the corn market. It seems that the data set would break easily into the two categories. However, it is more advantageous to have plans which can be useful in any market.

One item which will be included to reflect reality is the change in the daily trading limit. Limits are specified as to how far the price for any one commodity can move during a trading session. These are imposed by the exchange. Limits exist to enable traders some time to reevaluate the market. Sometimes the price is allowed to fluctuate as much as it can when the option is near expiration or there is a drastic change in fundamental conditions. Almost always there is a limit. Once the price hits the limit either up or down, trading activity generally declines. The reason being that those on the profitable side of the market believe the price will continue to move favorably and do not want to liquidate their positions. Those losing stay in the pits desiring to trade while the others exit. The limit has undergone one change. It mounted to ten cents from eight cents (30) on June 1, 1973. For most of the period eight cents was the effective trading limit.

Before dwelling on the mechanical strategies, real world practices need to be discussed to see what producers or elevator operators may actually do. Actual experience shows there are four possibilities. It is assumed that

the decision maker empties his facilities of the grain by the expiration of the crop season.

One practice is to sell at harvest. This may be caused by lack of facilities or simply tradition. The next alternative which arises is selling randomly. The major justification for this is that producers will liquidate due to some cash need. An example may be a mortgage or feed payment.

The producer is confronted with two reasons for employing the futures market. One strategy refers to the necessity to cover production costs due to the level of risks carried by the producer. To cover these risks a hedge may be placed at planting time by selling a December futures. The elevator operator would perform a similar transaction if a farmer contracted for harvest delivery. The hedge is lifted on December 1. The cash grain is sold on the same day. The second relates to the desire for storage income. This need for profits by the producer from storage equals that of the elevator operator. This hedge is designated as a transaction initiated on December 1 for July delivery. The alternative is consummated on July 15 with the cash disposed of locally.

Basis charts show that most of the basis gains are incurred by March 1. However the March basis is included in the July basis. All hedges are executed on the close of the designated day. If the stated day is not a working day, the trade is made on the following business day.

The two blind hedging operations can utilize a variation, which involves terminating a hedge when a substantial loss has been accumulated. Most hedgers are not die-hards. Producers tend to fall into this category. Rational decision-makers will close out the futures transaction before the

hedging loss wipes out a potential profit. One major determining factor may be the restrictions on credit. One may be forced to relinquish his position. It will be assumed that for this study that 10 percent of the hedged price is the reasonable limit for a loss on blind hedges. The hedge is consummated at the hedged price plus 10 percent. Once the hedge is ended, the corn is stored until the designated cash selling date.

While two of these alternatives may typify actions of producers more than elevator operators, they can be translated for the latter group also. The strictly cash grain operations can be thought of as buying cash and immediately selling "to-arrive." Hedging possibilities are easily employed by both groups. The net returns for each naive strategy (including the harvest and planting hedges without the ten percent stop-loss) will be analyzed using the F-test. The returns will be ranked using the method of least significant differences (35) if the F-test detects a significant difference among the means.

Proceeding into the heart of the investigation each proposed marketing strategy will be tested throughout the designated time period. Simulation models will be run on the computer. An attempt will be made to modify each strategy in order to improve its usefulness. However, each alternative will be allowed to stand or fall on its own merits before and after adjustments. The marketing alternatives are as follows: (a) basis change, (b) three-point reversal method, (c) simple moving average, (d) major price trend directional indicator, (e) exponential smoothing, and (f) trailing stop. Outlook and other farm publication suggestions will be compared to the other alternatives.

The buying basis should be as large as possible. When closing the transaction one wants a small selling basis. The basis would generally reach its maximum sometime during harvest. It would continue to narrow as the season expired up until the next year's crop was ready for harvest at which time it would widen. The basis follows a recurring pattern and tends to approximate the same difference at comparative stages of the crop year. It may be positive or negative depending on location. If the basis is less than the historical average it may be advantageous not to hedge. A study of basis patterns for a number of years indicates that there are occasionally substantial departures from the average which offer profit opportunities to owners of inventories. It appears that there is a substantial increase in the basis at higher grain prices. Carrying costs are greater and so are the risks. Elevator operators establish bids to protect their position.

Prudent hedgers need to know their basis. A strategy formulated for making decisions based on basis changes was derived by calculating an average daily basis and standard deviation of the basis for the entire period. These daily figures were converted into weekly averages to eliminate the effects of highly unusual events. Normal distribution is assumed for the basis for any given time period. The strategy commences on October 1 as elevators begin buying corn at that time from farmers who have started harvesting. The hedging decision is based on the relation of the current basis to the weekly average. When the basis is average or less one remains open. If the basis is wider than normal one also refrains from hedging as it may widen further. As long as the basis continues to widen one profits by remaining open. When the basis narrows

by one standard deviation from a previous peak a hedge should be executed. The position is maintained until the basis begins to widen by one current standard deviation from its lowest point. Once this happens the hedge is closed out.

Looking at the basis change strategy as a series of equations they would be as follows:

DB > AWD	Remain open
DB = AWD	Remain open
DB < AWD	Remain open
DB = DB maximum - AWSD	Hedge
DB = DB minimum + AWSD	After hedging, liquidate at this level,

where DB means daily basis, AWD is the average weekly basis for the investigated period and AWSD is the average weekly standard deviation. This mathematical explanation constitutes the first strategy.

Futures charts are tools which attain their reliability from the fact that those who trade watch them with intense interest. They all supposedly abide by the same rules. There is generally little if any economic justification for their methods. It is the major method for technical analysis. The bar charts as previously mentioned involve too much subjective judgment. See Figure 1a for an example of a bar chart. The horizontal axis is time and the vertical axis shows the prices. The vertical mark indicates the range of that trading session while the horizontal slash demarcates the close.

Point and figure charts are much different (47, 48, 49). They consist of a graph of X's and 0's. The vertical axis again is price and time adjusted to the trading range which lies on the horizontal axis. Whether an X or 0 is marked on the chart is determined by examining the high or the

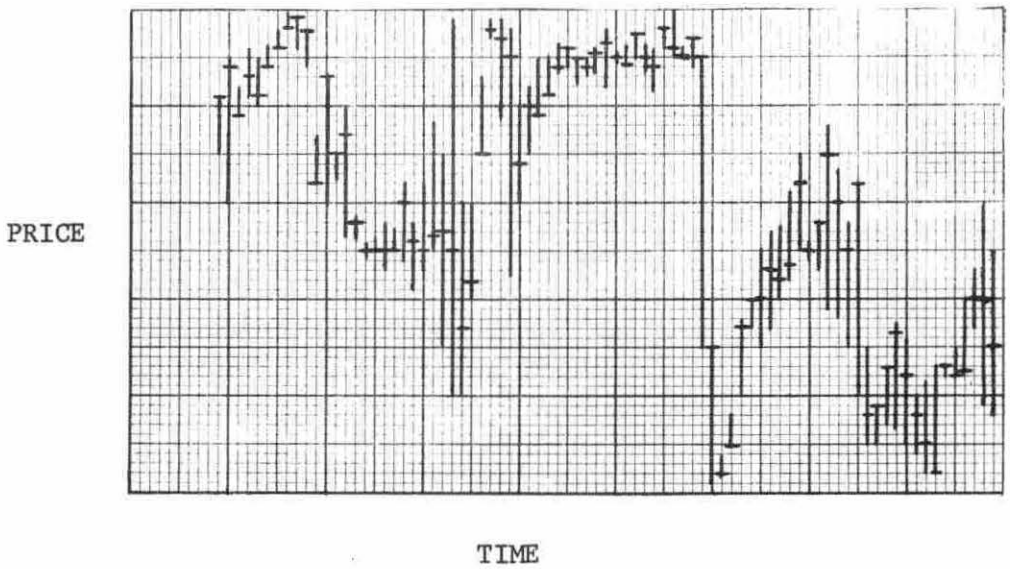

Figure 1a. An example of a bar chart for live hog futures

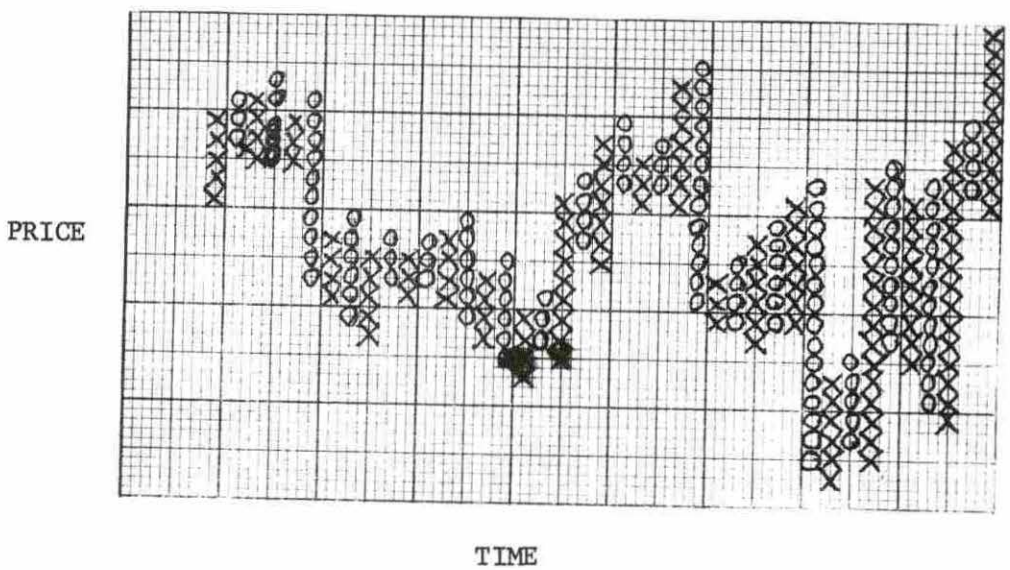

Figure 1b. An example of a point and figure chart

low of the trading range. It is claimed that point and figure charts paint a clearer picture of the prices. Each box represents two cents when constructing a corn chart. Therefore only the significant moves are detected and the smaller ones are ignored. The price changes used varies with the commodity charted.

The trading range must cover three or more boxes before any change is made in the chart. If the close exceeds the midpoint of the range X's are put in the three or more boxes. If the close occurs below midrange O's are placed in the boxes. For example, if December corn climbed from $2.80 to $2.85 during the session finishing at $2.84, three X's would be placed in the boxes. If the close was $2.81 O's would be placed in the boxes.

If the range fails to span three boxes dots are placed in the region as a reminder for the coming trading session. If the next day's price exceeds the previous day's price the dots are erased and X's are substituted for the entire two day range. If the next day produces a lower price entering the immediate lower box, O's replace the dots. If the example had shown corn moving from $2.80 to $2.83 dots would be penciled in the area. On the next day if the price rose to $2.85, the boxes would be Xed and the dots removed. If the price declined to $2.79 the dots would be erased and O's would be drawn in the region.

The following procedure would be used to chart the next day's range. Assuming the column is X's, the high would be surveyed first. If the top price enters a higher box they would be Xed in. As long as the daily high requires one to draw another X then the low is not considered. At some point the bull market will recess and the possibility for placing new X's in the column ends. When this event takes place, switch to the lows. If

the bottom price in the daily range is below the highest X by the value of three boxes (or six cents for corn), the price surge would be declared to be terminated. A column of 0's would be started to the right of the first which would be one box below the highest X.

Suppose that the value of corn jumped to $2.90 and the boxes were Xed accordingly. There would be a column of X's stretching from $2.80 to $2.90. The following session prices range from $2.84 to $2.91. There is a failure to enter a new box so the low must be investigated. Trades were made three boxes below the previous high as a column of 0's begins to the right one box below the highest Xed box attained.

It should be noted that this is the "three point reversal method" as nothing on the chart is changed until the low has declined at least six cents (three boxes). In essence, it stands unchanged until there is a significant move.

The method used for the bear market is reversed from the one used for a bull market. The lows become an indication rather than the highs. Each day's low is considered to determine if 0's can be placed in new boxes. When one is unable to mark a new box the high is automatically the decision variable. If the high is three boxes or more above the lowest 0 in the previous column a turnaround may have taken place. Nothing is done if it fails the test. A reversal has occurred if the test is passed. A new column of X's is one box higher than the bottom of the 0 column. The sample chart which illustrates the example discussed can be found in Figure 1b.

How are trades initiated? A speculator would buy at the moment the new row of X's exceeds the next closest row of X's to the left by one box.

This buy signal also represents the price at which short positions should be liquidated. In other words, it is a stop-loss if one has sold. The example which indicates the inception of a long position can be found in Figure 2A.

The signal to go short is obtained from the bottom of the columns. One surveys the lowest box of 0's to the right. As soon as the new column plunges below the old column next to it, sell. Again it is a stop-loss for terminating a long position. A chart which exemplifies the above discussion will be found in Figure 2b.

This strategy allows one to hedge by using the sell signals and to liquidate at the buy signals (stop-loss). In essence, the prospective hedger remains open when price rises and enters the market on price declines. This is one alternative strategy which would be easy to implement due to its simplicity.

The third trading strategy is known as the ten-day moving average rule (24). It is easily applied with some simple calculations. It involves the average daily price and the range averaged over ten days. A hedging price is determined from these two figures. To select the hedging price, sum the high, low and close and divide by three. This is the daily average price. To attain the average price for the moving average, add the daily average prices of the previous ten days and divide by ten. The daily range is the difference between the high and low. The daily ranges are averaged over the same ten days. The following equations illustrate the method.

$$\frac{H + L + C}{3} = DA$$

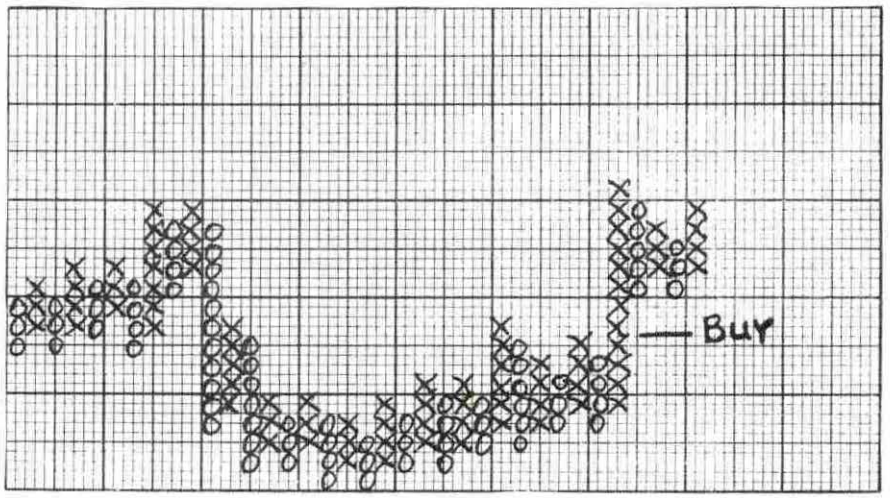

Figure 2a. An example of a buy signal on a point and figure chart

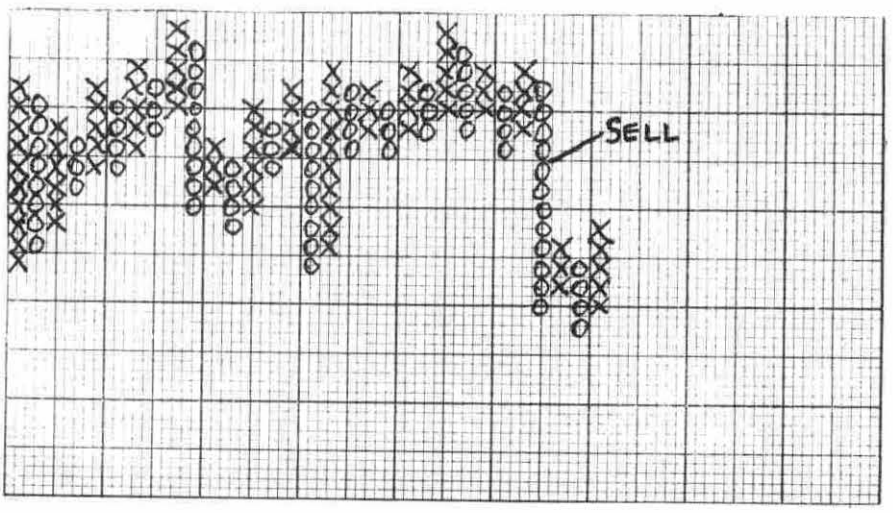

Figure 2b. An example of a sell signal on a point and figure chart

$$\sum_{i=1}^{10} DA/10 = DMA$$

$$\sum_{i=1}^{10} (H-L)/10 = DR$$

Where H is the high, L is the low, C is the close, DA is the daily average, DR is the daily range and DMA is the daily moving average.

Initiation of either a long or short position is executed in the following manner. The daily range is added to the daily moving average. This establishes the price at which a long position is taken. Likewise, subtracting the daily range from the daily moving average establishes the point for beginning a short position. Algebraically,

$$DMA + DR = BP$$

$$DMA - DR = SP$$

where BP is the buying price and SP is the selling price. Objectives for the forthcoming trading day are then as follows: (1) If the price hits one of these values, an appropriate position is taken according to the indicated stop. (2) If one were long, one would only observe the selling price to liquidate the long position and possibly go net short. If one were short, one would exercise the opposite position. For the purposes of this investigation the concern is the value for going short. A hedger would go short when the selling price is attained, end his commitment when the price climbs to the buying price and remain open until the selling price is reached again. The buying price is the stop-loss when one has sold.

The daily moving average and the daily range for the previous ten days are recalculated after the totals are available from the current trading

session. The ten most recent market sessions are always incorporated into the trading plan. In other words at the end of each trading session the moving average is refigured.

The simple moving average is an uncomplicated mathematical formula which levels off the prices by toning down the wide aberrations. The fourth strategy is a variation of the previous one. It is a weighted moving average. It uses the basic principle of the last plan plus a number of variations. To simplify the plan, for use in a highly volatile market, the near-by days compose a greater portion of the average than the distant ones. The second simplification to enhance understanding pertains to the number of days included in the average. As daily trading range enlarges, fewer days are needed in the calculations. This one is titled the Major Price Trend Directional Indicator (37).

The simple moving average gives each day equal weight. There are a large number of variations of moving averages of which these two appear to be representive. To implement the weighted moving average, one first tests the daily trading range. It should be understood that the market being considered should have at least two ten percent price swings during the season. During a calm market for corn a one to two cent average daily trading range (for five to ten tradings sessions) would be typical. The number of days in the average is increased when the average daily range climbs to a certain established level. The calculations for the weighted moving average in a tranquil market would encompass twenty-five days. The oldest five day's closes would be multiplied by one. The days from six through ten are doubled. The period from eleven to fifteen are tripled with the days extending from sixteen to twenty quadrupled. The

most current five days are multiplied by five. These multiplications are summed and divided by seventy-five (the sum of the multiplication factors) to ascertain the figure that guides decision making. Seventy-five represents the total of the adding of factors in the directional indicator.

An example may be useful to demonstrate the relative simplicity of the strategy. Five days will be adequate for our example. Assume the closes each day for corn for one week were as follows: $3.22; $3.32; $3.35; $3.31; and on the last day $3.33. The most recent day receives the most weight. Therefore, $3.33 would be multiplied by five. Thirty-three percent weight is placed on the last day. The remainder of the procedure is shown below.

Monday	1 X 3.22	=	$3.22
Tuesday	2 X 3.32	=	6.64
Wednesday	3 X 3.35	=	10.05
Thursday	4 X 3.31	=	13.24
Friday	5 X 3.33	=	16.65
	15		$49.80

The factors are added to total fifteen. The factor total is divided into the sum of the weighted closes. The answer ($3.25¼) is the marker for implementation of Major Price Trend Directional Indicator (MPTDI).

Once the decision making price is fixed, a speculator watches for a jump of three cents above the set price during the trading session for a signal to buy. A short position would be initiated at three cents below the benchmark. In the example, one would purchase a contract at $3.28¼ and sell at $3.22¼. If neither of these objectives is reached, the formula is reworked dropping the oldest day and including the current expired session. The new answer sets guidelines for the next day's action. The same rules are applied as signals to trade.

The fifth trading scheme to be investigated is of a different nature than the previous two schemes, but again the basic principle of remaining open on price increases and going short on declines is used. The technique is termed exponential smoothing (31). It is a variation of a moving average.

$$NM = OM + C(P - OM)$$

Where NM is the new moving average, OM is the old moving average, C is the smoothing constant and P is the current closing futures price.

The smoothing constant, C, is the key. C is derived by mathematical analysis. It functions in much the same way as the weighted moving average. The older days receive less value in the calculations than the most recent, however, there is one difference. The relationship is exponential rather than being linear. C varies between one and zero. When C tends to one the more rapidly the formula's result will trail the price. Higher values are needed to give reliable guidelines in a highly volatile market. Smaller values for the smoothing constant supposedly give better indications in a stable market.

The selection of the smoothing constant is determined by experimenting with the data. One must ascertain the value which dictates the best results. The following table designates some rough guidelines.

Smoothing Constant	Total weight of Most Recent N Days	N
.05	89.6%	44
.10	90.2	22
.20	89.2	10
.30	88.2	6
.40	87.0	4

The C value must be under constant scrutiny. As the market climate changes so does the smoothing constant. The initial starting point is derived by taking the average of the closing prices of the last ten days. Signals for entry are given by the intersection of the moving average price by the closing price.

Working through an example, assume the ten day average price for corn is $3.00. The closing price for the same ten days turns out to be $3.05. The smoothing constant incorporated into this trial run is $.20. It possibly should be $.30 due to the volatility. The results must be tested to pinpoint the exact smoothing constant. The new decision making price is arrived at by adding $3.00 + .2($3.05 - $3.00). The result sums to $3.01. If market price rises to meet indicated price by the close, a long position would be taken. When the price retreats to price given by the equation, the long position is stopped out and one takes a short position.

This strategy is not as clear cut as the previous ones. It requires experimentation to develop the proper smoothing constant. It is suggested that $.12 (31) is appropriate for the current corn market. The stop-loss may be modified to enhance the profitability of a different smoothing constant as being more appropriate.

The object of these mechanical strategies is not to trace the market price exactly. If this were the case, there would never be entry. It is mandatory that the values provided by these strategies miss the actual price. This allows the trading plans to capture the benefits from a turn around in the market.

The final proposed strategy is a development of the author. It resembles the other plans in a very basic way. It is a concoction of

trailing stop-sells and trailing stop-losses. It is designed for the decision maker, when hedging, to be open during price surges and protected against price declines. It can be adapted to speculation. The basic trading rules are as follows: (1) Set a trailing stop-sell a specified distance from the current price. As the price advances so does the potential selling price. A requirement is never to lower the stop-loss. (2) After the short position is entered, the stop-loss is positioned at a designated distance from the current market price. During the price drop the stop-loss follows the downward movement but it is never raised.

Execution of the hedge occurs when the current price contacts the trailing stop-sell. Immediately the stop-loss takes effect. Both stops would be placed at a point greater than a limit move during a volatile market. Therefore if the limit is shifted the stop is set in a position to compensate for the move. The reasoning behind the placement is the tendency for severe overnight investigation by traders after a limit move. Once the value of the grain hits this barrier one logically begins searching for the justification for the price behavior. If the move continues the stop will be moved in the appropriate direction and a hedging transaction would not be made. Likewise in a rather calm market with no major price moves the stops would be less than a limit move. Determining when a volatile market exists and the stops to use in a tranquil market will be established by testing the data.

One can observe by surveying the data for the period 1962 to 1973 that the market moved from a remarkably stable situation to one of rapid fluctuation in the later years of the period. The grain market has entered a new era from one of oversupply. The trading rules were shifted on several

occasions to reflect this situation. Recognition of this fact is imperative to the reasoning and justifications behind this strategy. In addition, experts on speculation say, "Let your profits run and cut your losses short." This theory should apply as well to hedging.

As a further check on the results of this investigation, the results of each suggested strategy will be compared to the market analysis provided by Iowa Farm Outlook. Using the guidelines given in these articles the appropriate market decision will be executed. This comparison will pit technical analysis against fundamental analysis. Seldom if ever does one find an author of one of these publications who mentions anything of a technical nature. They are for the most part fundamentalists.

To test this plan one would sell on the approximate date of the publication's arrival. Generally, readers examine the magazine or bulletin on the day it is received or the day after. If the marketing section advises the producer to hedge the order is transacted. Entries and exits to the market will be in accordance with the suggestions of these authors. For this study Iowa Farm Outlook, a publication prepared by the extension economists at Iowa State University, will be used. It should provide a well-founded, unbiased base for a fundamentalist alternative. Other publications may, perhaps, propose more actions but this may be an attempt to sell more magazines.

Modifications of these mechanical hedging strategies may be required. The annual net benefits of each plan will be tested for statistical significance at the five percent level. Commissions and interest costs for margin money will be deducted. The annual net income of each of the proposed hedging strategies will be compared to the naive alternatives

currently in practice using their respective mean net prices and the standard deviations. Hopefully, the results will translate into potential earnings for producers and grain firms in Iowa.

The storage income from each strategy will be compared to what was paid to warehousemen by ASCS for holding corn in their facilities. These costs (1) are as follows:

1/1/62	- 6/30/63	.037 of one cent/day/bushel
7/1/63	- 6/30/71	.036 of one cent/day/bushel
7/1/71	- 6/30/73	.040 of one cent/day/bushel
7/1/73	- 12/31/73	.043 of one cent/day/bushel

Another control in the storage income comparison will be the normal cash price rise (or fall) from December 1 to July 15. Storage income from the remaining strategies will be derived by the difference between the cash price on December 1 and the net return for the respective marketing plan on July 15. Again the same statistical tests as before will be used to compare results.

RESULTS

Naive Strategies

The outcomes of the naive strategies will be examined first. These strategies are thought to be a realistic approximation of what producers do or can do. When comparing the gross returns of these four alternatives in Table 1, it is found that during the entire period selling at harvest was never the most beneficial alternative. In seven of the eleven crop years selling at harvest was the least desirable possibility.

In six of the seasons the best results were generated from the blind hedges with a ten percent stop-loss. Only four times were the gross earnings from hedging at planting greater than selling at harvest. The harvest hedge produced larger gross earnings than harvest liquidation every crop year. Both blind hedges paid the same gross income during the 1967-68 season. Otherwise, the storage hedge on December 1 earned equal or greater returns every season except for 1969-70 and 1971-72.

Random selling was the most profitable of the naive strategies five times during the period. Random selling did not exceed the next best strategy by a margin of more than ten cents per bushel. The analysis of variance test should indicate whether this was a mere chance happening or a meaningful difference.

The rankings of the strategies when net returns are compared are essentially the same as the rankings from gross returns. Commission and interest expenses on the margin money rose as time elasped but never were these costs so substantial as to change the outcomes already discussed. These results are presented in Table 2a excluding inventory costs.

Table 1. Gross returns from naive strategies

Crop year	62-63	63-64	64-65	65-66	66-67
Selling cash corn at harvest on or near 12/1	$ .94 1/2	$ .99 1/2	$1.08 1/2	$1.04 1/2	$1.23 1/2
Hedge at planting time (at or near 5/20) in December futures	$1.18 1/4	$1.14 1/4	$1.17 5/8	$1.19 1/8	$1.21
Liquidation on or near 12/1	1.07 5/8	1.15 5/8	1.21 1/2	1.19 5/8	1.33 1/8[a]
Returns (losses) from hedging	+.10 5/8	-.01 3/8	-.03 7/8	-.00 1/2	-.11 7/8
Cash price on or near 12/1	$ .94 1/2	$ .99 1/2	$1.08 1/2	$1.04 1/2	$1.23 1/2
Returns from hedging	+.10 5/8	-.01 3/8	-.03 7/8	-.00 1/2	-.11 7/8
Gross returns	$1.05 1/8	$ .98 1/8	$1.04 5/8	$1.04	$1.11 5/8
Hedge at harvest (on or near 12/1) in July futures	$1.15 1/8	$1.24 5/8	$1.29 3/4	$1.26 5/8	$1.53
Liquidation on or near July 15	1.28	1.20 3/8	1.29 1/8	1.39 1/4[a]	1.28 1/2
Returns (losses) from hedging	-.12 7/8	+.04 1/4	+.00 5/8	-.12 5/8	+.24 3/4
Cash price on or near 7/15	$1.14 1/2	$1.03 1/2	$1.11 1/2	$1.22	$1.16
Returns from hedging	-.12 7/8	+.04 1/4	+.00 5/8	-.12 5/8	+.24 3/4
Gross returns	$1.01 5/8	$1.07 3/4	$1.12 1/8	$1.09 3/8	$1.40 3/4
Random selling	6/17/63	4/28/64	3/18/65	6/3/66	9/11/67
	$1.12	$1.12 1/2	$1.15 1/2	$1.09	$1.00

[a]Ten percent stop-loss in effect.

Table 1. (continued)

Crop year	67-68	68-69	69-70	70-71	71-72	72-73
Selling cash corn at harvest on or near 12/1	$ .95	$1.01 1/2	$1.02	$1.28	$ .97	$1.27
Hedge at planting time (at or near 5/20) in December futures	$1.32 7/8	$1.19 1/4	$1.26 1/8	$1.20 3/4	$1.38 3/8	$1.27 1/8
Liquidation on or near 12/1	1.14 1/8	1.14 1/2	1.17 5/8	1.32	1.15 1/4	1.39 3/4[a]
Returns (losses) from hedging	+.18 3/4	+.06 3/4	+.08 1/2	-.11 1/4	+.23 1/8	-.12 5/8
Cash price on or near 12/1	$ .95	$1.01 1/2	$1.02	$1.28	$ .97	$1.27
Returns from hedging	+.18 3/4	+.04 3/4	+.08 1/2	-.11 1/4	+.23 1/8	-.12 5/8
Gross returns	$1.13 3/4	$1.06 1/4	$1.10 1/2	$1.16 3/4	$1.20 1/8	$1.14 3/8
Hedge at harvest (on or near 12/1) in July futures	$1.24 1/4	$1.23 1/2	$1.27 1/4	$1.58 3/4	$1.25 5/8	$1.52 3/4[a]
Liquidation on or near July 15	1.11 1/2	1.28 1/4	1.35 1/2	1.49 3/4	1.24 1/8	1.68
Returns (losses) from hedging	+.12 3/4	-.04 3/4	-.08 1/4	+.09	+.01 1/2	-.15 1/4
Cash price on or near 7/15	$1.01	$1.13 1/2	$1.18	$1.29	$1.08 1/2	$2.11
Returns from hedging	+.12 3/4	-.04 3/4	-.08 1/4	+.09	+.01 1/2	-.15 1/4
Gross returns	$1.13 3/4	$1.08 3/4	$1.07 3/4	$1.38	$1.10	$2.05 3/4
Random selling	6/24/68	8/18/69	2/26/70	3/25/71	12/2/71	10/19/73
	$1.00 1/2	$1.14 1/2	$1.08	$1.35	$ .99	$2.07 1/2

Table 2a. Net returns from naive strategies

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Selling cash corn at harvest on or near 12/1 (T1)	$ .94 1/2	$ .99 1/2	$1.08 1/2	$1.04 1/2	$1.23 1/2	$ .95
Hedge at planting (on or near 5/20) in December futures and liquidate on or near 12/1 (T2)	$1.04 1/2	$ .97 1/2	$1.04	$1.03 3/8	$1.10 7/8	$1.13 1/8
Hedge at harvest (on or near 12/1) in July futures with liquidation on or near July 15 (T3)	$1.01	$1.07 1/8	$1.11 1/2	$1.08 5/8	$1.40	$1.13
Random selling (T4)	$1.12	$1.12 1/2	$1.15 1/2	$1.09	$1.00	$1.00 1/2

Table 2a. Continued

Crop year	68-69	69-70	70-71	71-72	72-73	Average for each strategy (rounded)
Selling cash corn at harvest on or near 12/1 (T1)	$1.01 1/2	$1.02	$1.28	$ .97	$1.27	$1.07 3/8
Hedge at planting (on or near 5/20) in December futures and liquidate on or near 12/1 (T2)	$1.05 5/8	$1.09 7/8	$1.15 3/4	$1.19 1/4	$1.13 3/8	$1.08 7/8
Hedge at harvest (on or near 12/1) in July futures with liquidation on or near July 15 (T3)	$1.08	$1.07	$1.36 7/8	$1.09 1/8	$2.04 5/8	$1.22 7/8
Random selling (T4)	$1.14 1/2	$1.08	$1.35	$ .99	$2.07 1/2	$1.19 3/8

Discussion of hedging in textbooks generally takes for granted that once a hedge has been established liquidation does not take place until the commodity is sold in the cash market. Disallowing the ten percent stop-loss, the net return for the planting hedge in 1966-67 is $1.00 1/4 and $1.08 5/8 in 1972-73. This reduces mean net price to $1.07 1/2. The harvest hedge rose to $1.09 3/8 in 1965-66 and in 1972-73 jumped to $1.20 7/8. Average net return for the harvest hedge dropped to $1.14 3/4. Benefits may accrue from having stop-losses on hedged positions. Table 2b summarizes and ranks all the naive strategies according to mean net price after interest cost for carrying inventory was subtracted. Interest cost on inventory is presented in Table 10b. None of the outcomes in the tables will have excluded the interest cost on inventory except Table 10c.

The harvest hedge with the stop-loss surpassed other alternatives as it had the highest mean net price. Some producers prefer this alternative over random selling because it has a slightly lower standard deviation. There was a 2¼¢ spread between the second-ranked random selling strategy and the harvest hedge strategy without stop-loss technique. The standard deviation of the third ranked strategy was less than one-half the standard deviation for random selling. A wide gap existed between averages of the third and fourth marketing systems. The planting hedge utilizing stop-loss had a standard deviation of the third best marketing system. The two planting hedges fared about the same in mean net price and standard deviations; however, operation with the stop-loss averaged slightly more. Selling at harvest landed in sixth place by 1/8¢ on the average. The harvest selling strategy had a standard deviation double those of the planting hedges.

Table 2b. The mean net price and standard deviation for each naive strategy (ranked from largest mean to the smallest mean) with interest expense for carrying inventory deducted

	Strategy	Mean net price	Standard deviation
T1	Harvest hedge with the 10% stop-loss	$1.17 1/2	$ .300
T2	Random selling	$1.15 1/4	.308
T3	Harvest hedge without the stop-loss	$1.09 3/8	.127
T4	Planting hedge with the 10% stop-loss	$1.08 7/8	.064
T5	Planting hedge without the stop-loss	$1.07 1/2	.066
T6	Harvest sale	$1.07 3/8	.128

In order to determine a definite ranking of the results it must first be ascertained if there is a significant difference between the various strategies or treatments. The F-test is generally appropriate for this test. The data generated an F-value of .521 as compared to a value of 2.37 necessary for significance found in a table (35) of F-values at the five percent level. One must conclude from this test that there is no difference among the means.

In summary, one may reason that the harvest hedge with the stop-loss and random selling may be the better strategies for the period of years investigated even though the F-test could not detect a difference. This reasoning is based on the mean net price and standard deviation.

Basis Strategy

An analysis of the net returns showed a phenomenal range. The net benefits ranged from a $1,179.03 profit in 1966-67 to a devasting loss of $4,815.23 in 1972-73. This marketing plan earned positive returns when the basis behaved near its historical average. The mean net price was $1.13 3/4 with a standard deviation of $.097. This system produced consistent returns as demonstrated by the low standard deviation. These results are displayed in Table 3a.

Examining the results more thoroughly it is discovered that six of the eleven seasons required less than $400.00 as a maximum invested in margin. The 1972-73 crop year required $1,575.00. 1964-65 had the minimum margin requirement of $231.25. Accordingly, the interest expense exceeded $10.00 only five times. During the 1966-67 season, there was a $7.28 income from margin withdrawn as paper profits. 1972-73 became the record season for

interest expense at $16.48. The same crop year ranked number one in number of transactions with 11. The basis followed an unusual pattern by narrowing a few cents from harvest then exploding at times throughout the remainder of the crop year. The volatility of the basis caused one following this strategy to enter and exit the market 11 times. Therefore, $330.00 was spent on commissions. The remaining crop years had three transactions or less per season. Four required only one trade.

The net benefits were losses seven out of 11 times. The four profitable years ranged from $50.66 in 1963-64 to the $1,179.03 already mentioned. The losses began at $51.99 in 1970-71 and dropped to the huge 1972-73 figure. Five of the losing crop years were less than $500.00. In summary, this strategy showed stability and did not accrue tremendous expense for commissions except during the 1972-73 crop year. This is undoubtedly related to the fact that the basis follows a regular pattern.

In examining the results of this marketing plan, one realizes that the hedges were placed when the basis was too narrow. Most of the profits from basis change had elapsed before market entry. In addition, it allowed several transactions during the same crop year when the basis was behaving normally. Of course one can do little to counteract a crop year like 1972-73. When huge price surges persist cash prices lag behind futures causing a wider basis. Generally the basis will be greater at higher price levels than at lower ones.

In order to improve the possible returns from marketing corn using the basis several modifications were made in the simulation model. The revised basis hedging strategy attempts to capture a wider basis by

Table 3a. Basis strategy

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	2	2	2	3	1	2
Maximum investment in margin	$381.25	$325.00	$231.25	$350.00	$400.00	$337.50
Earnings (losses) from futures (July option)	(262.50)	106.25	137.50	(581.25)	1,193.75	462.50
Commissions	44.00	44.00	44.00	66.00	22.00	44.00
Interest expense (income)	6.22	1.59	11.02	8.85	(7.28)	5.91
Total earnings (losses) from the strategy	(312.72)	50.66	82.48	(656.10)	1,179.03	412.59
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.08 1/4	1.04 1/2	1.13 1/8	1.08 7/8	1.39 5/8	1.09 1/4

Table 3a. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	1	1	2	1	11
Maximum investment in margin	$600.00	$818.75	$562.50	$481.25	$1,575.00
Earnings (losses) from futures (July option)	(193.75)	(437.50)	12.50	6.25	(4,468.75)
Commissions	22.00	30.00	60.00	30.00	330.00
Interest expense	13.18	13.49	4.49	12.54	16.48
Total earnings (losses) from the strategy	(228.93)	(480.99)	(51.99)	(36.29)	(4,815.23)
Cash price on or near 7/15	1.13 1/2	1.29	1.18	1.08 1/2	2.11
Net return from the strategy (rounded)	1.08 7/8	1.19 3/8	1.17	1.07 1/2	1.14 3/4

comparing the current daily basis to the average weekly basis for the respective week. If the daily basis is equal to or greater than the average by a standard deviation plus one-half cent a hedge is initiated. It is thought the basis may be near its summit at this point.

A limit is placed on both sides of the hedge. A stop-loss is positioned one-half of an average weekly standard deviation above the daily basis at the time of market entry. It is placed sufficiently near the market entry to curb gigantic losses. The one-half average weekly standard deviation puts the stop at the end point of the normal distribution. If the stop-loss is executed the reentry point becomes one average weekly standard deviation. If this portion of the modified basis strategy becomes effective the basis will be abnormally wide.

The other limit will hopefully close out the hedge when it is narrow. Liquidation will occur when the daily basis is less than the average weekly basis by more than one standard deviation plus one-half cent. At this point the strategy will revert back to checking for a wide basis unless the owner chooses to liquidate his cash position.

This marketing system can easily be adapted to a series of equations. They are as follows:

1.	CDB = AWB + (AWSD + \$.005)	Hedge initiation
2.	HSL = CDB[1] + 1/2 AWSD	Stop-loss on existing hedge
3.	HRE = PDB + 1[2] AWSD	Reentry of liquidated hedge
4.	CDB = AWB - (AWSD - \$.005)	Hedge liquidation or the last session on or near July 15

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[1]Current daily basis at the beginning of the hedge.

[2]It is also tested with a one-half AWSD.

Where CDB is the current daily basis, AWB refers to the average weekly basis and AWSD is the average weekly standard deviation. HSL is the stop-loss for the current hedge while HRE is the reentry hedge if the stop-loss was effective. PDB means peak daily basis. Once hedge liquidation occurs, the strategy reverts back to equation 1.

The modified basis strategy, using the one-half average weekly standard deviation stop-loss, gave a profitable return every crop year except 1972-73. The loss that year amounted to nearly $1.00 per bushel. This was the only crop year where the stop-loss terminated a trade. In other words, there was either one trade or none at all for the rest of the seasons. During the 1962-66 and 1968-70 crop years, there were no trades. The basis was so narrow that the producer could gain little from hedging. He may lose five to six cents by the use of the strategy but the plan attempts to guard against major price declines.

Evaluating the net returns, the profits ranged from $136.09 to $702.98 over the four crop years with one market entry. This strategy required little commission expense except for 1972-73. The abnormal basis behavior resulted in eight transactions with an overwhelming loss of $4,991.05. The interest expense was at $38.55. The maximum investment in margin rose to $4,662.50. The results for 1972-73 were not improved by moving from one-half to one standard deviation. The net loss fell to $5,592.33. This variation will be excluded due to its failure to enhance the returns. The greater loss may be partially explained by a delay in market entrance and exit when the price moved substantially.

Reviewing the other four crop years where the strategy was in effect, interest expense ranged from $1.17 in 1970-71 to $8.91 in 1971-72. The

Table 3b. Modified basis program

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	0	0	0	0	1	1
Maximum investment in margin	0	0	0	0	$625.00	$343.75
Earnings (losses) from futures (July option)	0	0	0	0	731.25	343.75
Commission	0	0	0	0	22.00	22.00
Interest expense	0	0	0	0	6.27	5.90
Total earnings (losses) from the strategy	0	0	0	0	702.98	315.85
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.30	1.07 3/8

Table 3b. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73[a]
Number of entries into the market	0	0	1	1	8
Maximum investment in margin	0	0	$500.00	$393.75	$4,662.50
Earnings (losses) from futures (July option)	0	0	637.50	175.00	4,712.50
Commission	0	0	30.00	30.00	240.00
Interest expense	0	0	1.17	8.91	38.55
Total earnings (losses) from the strategy	0	0	606.33	136.09	(4,991.05)
Cash price on or near 7/15	1.13 1/2	1.18	1.29	1.08 1/2	2.11
Net return from the strategy (rounded)	1.13 1/2	1.18	1.34 1/8	1.11 1/4	1.11 1/8

[a]Only year affected by changing stop - loss from one-half to one standard deviation.

maximum investment in margin peaked at $625.00 in 1966-67. The other three were $500.00 and below. The mean net price for this marketing system was $1.16 1/8 with a standard deviation of $.093. This is a definite improvement over the first basis strategy.

Comparing the two basis strategies, one detects a poorly positioned liquidation point in the first basis strategy. The basis may narrow suddenly and then enlarge. Under the first basis strategy chances are that a hedge would have been closed and reopened. Its counterpart probably would have maintained a hedge throughout this short deviation from average. In essence, the modified basis captured a wider basis and allowed price to swing considerably before the hedge was stopped out. Using weekly averages alleviated the possibility of early liquidation. Once the hedge was made in the modified plan it continued until the latter part of hedging period.

Three point reversal method

Analyzing the three point reversal method one finds a strategy capable of signaling, under certain conditions, many market entries. Perhaps the six cent range, three boxes at two cents each, should be altered when highly volatile markets persist. During the 1972-73 crop year there were sixteen transactions. The greatest number of transactions for the other crop years was three. There was no trading in 1962-63. Five crop years had one trade. For the most part there was little trading with the exception of the final crop year. The mean net price for the time period hit $1.19 1/4 with a $.227 standard deviation.

The three point reversal method produced three profitable crop years and seven losing crop years. The net positive benefits reached $605.42 for

Table 4. Three point reversal method

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	0	1	1	1	3	1
Maximum investment in margin	0	$225.00	$275.00	($518.75)	$468.75	$250.00
Earnings (losses) from futures (July option)	0	(25.00)	(75.00)	(268.75)	625.00	625.00
Commissions	0	22.00	22.00	22.00	66.00	22.00
Interest expense (income)	0	.09	.18	6.45	5.97	(2.42)
Total earnings (losses) from the strategy	0	(47.09)	(97.18)	(287.20)	553.03	605.42
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.14 1/2	1.02 1/2	1.09 1/2	1.16 1/4	1.27	1.13 1/8

Table 4. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	1	2	2	2	16
Maximum investment in margin	$631.25	$500.00	$468.75	$300.00	$1,450.00
Earnings (losses) from futures (July option)	(375.00)	493.75	(287.50)	0	(843.75)
Commissions	22.00	60.00	60.00	30.00	480.00
Interest expense	2.61	4.04	6.10	1.12	9.78
Total earnings (losses) from the strategy	(399.61)	429.71	(353.60)	(31.12)	(1,333.53)
Cash price on or near 7/15	1.13 1/2	1.29	1.18	1.08 1/2	2.11
Net return from the strategy (rounded)	1.05 1/2	1.20 3/8	1.11	1.07 7/8	1.84 3/4

1967-68. All three profitable years had substantial gains. This strategy suffered a loss of $1,333.53 in 1972-73. Three years the losses were under $100.00. The maximum investment in margin was $1,450.00 in 1972-73. Five of the periods required less than $300.00 in margin. The margin for the other five crop years ranged from $468.75 to $631.25. The interest expenses were extremely low with this market strategy registering a low of nine cents in 1963-64. In 1972-73 interest expense was $9.78. This strategy would have resulted in an income of $2.42 in 1967-68. Six of the 11 time segments had interest expenses below $5.00.

This strategy was slow to react in a sluggish market. This was because the two cent value per box placed an undue restriction on the strategy. The major portion of the price move was past before the signal was given to sell. In 1972-73 the opposite was true and the strategy produced too many trades during the minor price bulges and troughs in the generally rising market.

To pinpoint the idiosyncrasies of this system more accurately, the individual crop years are explored in more detail. Three times a trade was terminated due to the July 15 deadline. This strategy was beneficial when gradual price rises and declines persisted. A producer would have fared well by following this strategy in 1970-71. A hedge was in effect until late May due to a market turnaround. Price rose until late June when another hedge was placed. It did not enter and exit at the very top or bottom due to six cents allowance built into the strategy. Sometimes six cents was excessive and other times insufficient. When there was a sudden price change in the middle of a move, it caused an unnecessary trade. A slight price variation caused the hedge to be closed out with

another hedge coming two sessions later. Price declines which took place over a period of four weeks created a loss of $247.94 in 1969-70 even though a bull market was in progress.

The last crop year investigated was a disaster for this hedging strategy. Daily ranges were sweeping with fluctuations being rapid. The longest duration of any hedge was nineteen days; seven of sixteen trades lasted two days or less. These were extremely quick price changes. These short term hedges produced the majority of the loss. The profits generally came from the trades which were in existence a longer period of time.

All trades were executed at the close. This may have lowered profits. However, when analyzing this strategy, it is difficult to commence a trade at any other time. The decision maker does not know until the end of the session whether a new box is reached either on the top or bottom side.

Simple moving average

Several modifications were made in order to generate better results from the simple moving average. Problems were encountered in programming due to entry and exit even though the market was either declining or climbing. The strategy would hedge due to a wide, chance fluctuation in the market. The entry price was intersected, so it sold. This was solved by programming market entry only when the average declined. It may not hedge on that day but it would scan the range. The strategy would hedge if the price was reached. Once in the market, exit did not take place until the average rose.

Inverting the entry and exit points was attempted and exhibited worse results than the designated procedure. One problem with a simple moving

Table 5. Net returns from simple moving average

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries	4	7	5	4	7	5
Maximum investment in margin	$300.00	$268.75	$262.50	$668.75	$543.75	$356.25
Earnings (losses) from futures (July option)	(50.00)	81.24	56.25	(362.50)	50.00	512.50
Commissions	88.00	154.00	110.00	88.00	154.00	110.00
Interest expense	5.44	10.53	7.48	6.44	9.39	4.46
Total earnings (losses) from the strategy	(143.44)	(83.29)	(61.23)	(456.94)	(113.39)	398.04
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from strategy (rounded)	1.11 5/8	1.01 7/8	1.10 1/4	1.12 7/8	1.13 3/4	1.09

Table 5. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries	3	4	5	4	5
Maximum investment in margin	$362.50	$262.50	$662.50	$431.25	$1,975.00
Earnings (losses) from futures (July option)	137.50	(6.25)	(12.50)	25.00	(1,718.75)
Commissions	66.00	120.00	150.00	120.00	150.00
Interest expense	6.70	3.96	6.31	6.76	9.15
Total earnings (losses) from the strategy	64.80	(130.21)	(168.81)	(101.76)	(1,877.90)
Cash price on or near 7/15	1.13 1/2	1.18	1.29	1.08 1/2	2.11
Net return from strategy (rounded)	1.14 3/4	1.15 3/8	1.25 3/8	1.06 1/2	1.73 1/2

average was that it indicated a hedge after the market had already moved down substantially. In essence, it was sometimes too late to hedge. It takes several sessions for the effects of lower prices to be translated into the average. There is no weighting. Bear markets plummet while bull markets climb gradually. The same phenomenon took place at the trough of the price movement. Exit would take place after price had risen a bit. Therefore, added gains are erased by this characteristic of the simple moving average.

The simple moving average generated losses every crop year except 1967-68 and 1968-69. These profits were $.08 1/4 respectively. Negative returns for the other nine seasons ranged from $.01 1/4 to $.37 1/2. The large loss occurred during the 1972-73 season. Six of these losing seasons generated losses less than three cents. The average net return was $1.17 3/4 with a standard deviation of $.194.

This strategy required fifty-three trades. The 1963-64 and 1966-67 crop years used seven entries and exits. These were the peak years. The 1968-69 period was the lowest with three transactions. Over the entire period $1,310.00 were spent on commissions. The interest expense never amounted to more than $11.00 in any one crop year of the investigation. The least interest expense incurred was $3.96. The 1972-73 crop required a maximum investment in margin of $1,975.00 which was the highest for the entire 11 year period for this strategy. The lowest maximum investment was in 1969-70 totaling $262.50. Seven of the 11 crop years required margin investments of less than $500.00.

Analyzing the simple moving average further one discovers that for the most part this strategy is a function of average daily range. When

the range is narrow small price changes can initiate a hedge. The average range moved between 3/8¢ and 1 3/8¢ during 1962-63. This caused too many trades to take place. In a sluggish market, like the ones at the beginning of the investigated period, hedges were executed when there was a relatively small price change. This strategy works best when the market maintains one direction or, if it turns, when the price reverses gradually. There is one further qualification. No sudden price surges can take place or hedges are placed when the market is still rising or falling. Of course in a sluggish market, entry and exit came too late. The price move was oftentimes complete before the hedge was executed. Many of the trades were of short duration. The two longest enduring transactions were 74 and 77 days during the 1965-66 and 1968-69 crop years respectively.

Major price trend directional indicator

The Major Price Trend Directional Indicator (MPTDI) is basically a modification of the simple moving average. Average net return was improved nearly five cents over the less complex model. The marketing plan remained at the twenty-five day calculation until the 1970-71 crop year. However, it did not shift to the type B (refer to the procedure) weighting until the last two months. The procedure used in 1971-72 reverted back to the pre-1971 method of computation. The model switched between the 15- and 20-day weighted average often during the 1972-73 crop year.

There were transactions executed every crop year. First place was won by 1968-69 with five trades. The other crop years had either three or four trades. Commissions did not devastate any one of the gains from futures market operations for any one crop year. Comparing outcomes by

Table 6. Major price trend directional indicator

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	4	4	4	3	4	4
Maximum investment in margin	$262.50	$281.25	$237.50	$343.75	$468.75	$312.50
Earnings (losses) from futures (July option)	(131.25)	81.25	106.25	0	568.75	493.75
Commissions	88.00	88.00	88.00	66.00	88.00	88.00
Interest expense (income)	3.32	10.04	7.41	4.47	6.53	(.93)
Total earnings (losses) from the strategy	(222.57)	(16.79)	10.84	(70.47)	474.22	406.68
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.10	1.02 7/8	1.11 5/8	1.20 5/8	1.25 1/2	1.09 1/8

Table 6. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	5	3	3	4	4
Maximum investment in margin	$356.25	$300.00	$500.00	$306.25	$1,475.00
Earnings (losses) from futures (July option)	(62.50)	(12.50)	512.49	106.25	(656.25)
Commissions	110.00	90.00	90.00	120.00	120.00
Interest expense	6.04	4.66	3.75	6.04	9.92
Total earnings (losses) from the strategy	(178.54)	(107.16)	418.74	(19.79)	(786.17)
Cash price on or near 7/15	1.13 1/2	1.29	1.18	1.08 1/2	2.11
Net return from the strategy (rounded)	1.09 7/8	1.26 7/8	1.26 3/8	1.08 1/2	1.95 1/4

crop years the losers outnumbered winners by one during the investigated period. The 1972-73 crop year had the greatest loss with $786.17. Two seasons marked-up losses of less than $20.00. Profits peaked at $474.22 in 1966-67. In 1964-65 the gain amounted to only $10.84.

The capital needs mounted to $1,475.00 in 1972-73. Eight of the 11 crop years required less than $360.00. The interest expense never exceeded $10.05 during the entire investigation. In 1967-68 an interest income of $.93 was earned. Four years registered interest expenses of less than $5.00. The weighted average (MPTDI) strategy made the proper change to reflect the market activity. The indicated entry point of the MPTDI did not lag the price movement as much as the simple moving average. However, the trades were still not initiated and liquidated with proper timing as too many losses were incurred.

Noting the differences between this strategy and the simple moving average one can count 11 fewer transactions for the MPTDI. This fact exists due to the three basic variables that exist in this marketing plan. The changing stop-loss, the weighting and the number of days involved in calculating the average are the three improvements. Many of the problems that persisted in the simple moving average are the same. There are still too many trades, especially those that lasted four days or less. The price only spanned a range of $.06 5/8 during 1964-65 yet there were four trades. The 1966-67 crop year was one of generally declining prices with four hedges. Overall, the plan generated a profit but an unnecessary in-and-out in early June lowered benefits by $128.88. The MPTDI maintained its hedges longer than the simple moving average. One hedge endured for

118 days in 1970-71. The lag problem created a majority of the loss in 1972-73. The MPTDI did not follow the market advantageously for the hedger.

Exponential smoothing

The exponential smoothing strategy was tested with one-tenth changes in the smoothing constant. The net returns from the nine different smoothing constants are presented in Table 7a. The 1962-63 crop year is the only one which exhibited a trend. The smaller-valued constants generated the greater returns. The other crop years demonstrated a similar pattern but there were aberrations. These were created by the different market entry and exit times indicated by this marketing plan. A one- or two-session delay can mean a several hundred dollar loss. Price moves oftentimes are rapid. Trading at the close may have decreased the returns. However, the profits and losses should offset each other.

The mean net prices resulting from all nine smoothing constants were tested to determine whether they were significantly different from each other. The F-test was employed and the F-value was calculated to be 3.10. Comparing this figure to the value given in the tables (35), 2.06 at the five percent level, one concludes that there is a difference between the means. The calculated F was greater than the F given by the F-table. The next step was a test of linearity. It was hypothesized that there was a linear relationship between the smoothing constant and its outcomes. As smoothing constant shrank the returns rose. The analysis of variance for this hypothesis can be found in Table 7c. These results show that a major portion of the relationship can be explained by a linear equation.

Table 7a. Net returns employing the exponential smoothing strategy

Smoothing constant	62-63	63-64	64-65	65-66	66-67	67-68
.1	1.12 1/2	.98	1.10	1.20 1/8	1.19 1/8	1.04 1/4
.2	1.08 1/2	.97 7/8	1.10 3/8	1.13 1/4	1.19 1/8	1.04
.3	1.06	.99 1/8	1.08 1/2	1.16 1/2	1.20 1/8	1.02 7/8
.4	1.03 3/8	.94 7/8	1.09 3/4	1.14 1/8	1.20 1/2	1.01
.5	1.02 3/4	.93 5/8	1.06	1.08 7/8	1.24 3/4	1.01 1/2
.6	1.02 5/8	.92 1/4	.99 3/8	1.09 7/8	1.27 7/8	1.02
.7	.98 1/8	.92 3/8	.99 3/8	1.08 5/8	1.16	1.04 1/8
.8	.97 1/8	.92 1/2	1.00	1.07	1.14 1/8	1.04
.9	.95	.92 3/4	1.01 3/8	1.02 5/8	1.19 7/8	1.02 3/4

Table 7a. (continued)

Smoothing constant	Crop year 68-69	69-70	70-71	71-72	72-73
.1	1.10 7/8	1.26 3/8	1.18 5/8	1.09 1/2	1.75
.2	1.06 5/8	1.19 3/8	1.28 3/8	1.09 5/8	1.76
.3	1.10 1/2	1.14	1.27 3/4	1.08	1.33
.4	1.07 1/2	1.18 1/2	1.26 3/8	1.07 1/2	1.10 3/8
.5	1.06 1/2	1.16 7/8	1.27 1/2	1.02 3/4	1.13 1/4
.6	1.02 1/2	1.16 1/2	1.23 1/8	1.01	1.05 3/8
.7	1.01 3/8	1.16 1/4	1.24 7/8	1.00 5/8	1.12 1/4
.8	1.05 1/2	1.15 1/8	1.18 3/4	1.01 1/4	1.15 5/8
.9	1.07 3/8	1.15 1/8	1.20 3/4	1.01 3/8	1.43 7/8

Table 7b. Net mean prices for different levels of smoothing constants

Value of smoothing constant	Average	Standard deviation
.1	1.18 5/8	.204
.2	1.17 1/2	.211
.3	1.13 1/4	.104
.4	1.10 3/8	.091
.5	1.09 1/2	.103
.6	1.07 1/2	.108
.7	1.06 3/4	.097
.8	1.06 1/2	.085
.9	1.09 3/8	.147

Table 7c. Analysis of variance

	Degrees of freedom	Sum of squares	Mean squares
Years	10	1.134	.113
Smoothing constants	8	.169	.163
Linear effect	(1)	.131	.131
Quadratic effect	(1)	.031	.031
Lack of fit	(6)	.007	.001
Residual	80	.543	.00678

Table 7d. Correlation coefficients for each individual crop year

Crop year	R^2
1962-63	.944
1963-64	.905
1964-65	.922
1965-66	.891
1966-67	.238
1967-68	.580
1968-69	.714
1969-70	.814
1970-71	.782
1971-72	.961
1972-73	.869

However, there was a significant quadratic effect. This effect may be explained by the higher mean net price for the 1972-73 crop year in Table 7b. One can conclude that the lower-valued smoothing constants generated significantly better outcomes when the entire 1962-73 period is considered. When reviewing Table 7b, one observes that the returns with the smoothing constant placed at the one-tenth level is clearly a better strategy. It has a higher mean net price and a lower standard deviation than the results at the level where C = .2.

Another hypothesis was tested for each individual year. It was hypothesized that for each individual year a different smoothing constant would be appropriate. More volatile markets would conceivably have larger smoothing constants. R^2, the coefficient of determination, was used as the measure. These values can be found in Table 7d. The outcomes for 1966-67 and 1967-68 demonstrated a low correlation. In general, one can again conclude that the relationship can be explained by a straight line. However, the results also point out that there are some quadratic effects exemplified by the lower R^2's. Perhaps the mean net prices for the crop years shield some things that might not have been detected.

In order to improve the outcomes of the exponential smoothing strategy, the outcome with the smoothing constant at the .05 level was computed. These outcomes are presented in Table 7e. The mean net price is $1.22 with a standard deviation of .255. The net average price at the .05 level was above the outcome with the constant at the .1 level. A smaller smoothing constant, .03, was tried for further improvement. Again, referring to Table 7e one discovers the trend continuing. A

smoothing constant with a value of .01 was selected next in an effort to add further improvement. The net average price leveled off.

In choosing the appropriate representative of the smoothing constant strategy, an F-test was conducted to ascertain whether or not there was a significant difference among coefficients. Therefore, the .03 smoothing constant was selected for it had a slightly higher mean net price. The detailed results of this strategy are presented in Table 7f.

There was an interesting turnaround in 1972-73 as no more transactions occurred during this period than for any of the other crop years. There were only two transactions. The 1963-64 crop year was first with seven trades. The smaller smoothing constant distributed the weight of each day's prices over a greater number of days. The 1971-72 crop year registered five market entries. In six of the eleven cases there were two or fewer transactions.

The greatest loss was generated in 1972-73 and this amounted to $539.08. Losing years outnumbered winning years by three. Five times losses were less than $225.00. In 1966-67 and 1967-68 profits were produced in excess of $600.00, $604.09 and $609.10 respectively. The interest expense never surpassed $6.27. In 1962-63 it amounted to only $.86. The crop year 1967-68 gave a $3.10 interest income. In other words, capital demands of this strategy were negligible. The maximum investment in margin is somewhat correlated to the interest expense (income). The peak year for margin requirements was 1972 with $650.00, and 1970-71 ran a close second with $562.50. The remaining crop years were all under $356.25 except 1966-67 which required $450.00. The least margin ($250.00) was needed during 1964-65.

Table 7e. Net outcomes for different levels of smoothing constant (rounded)

Crop year	Smoothing constant value		
	.05	.03	.01
1962-63	$1.11 3/4	$1.11	$1.14 1/2
1963-64	1.00 1/4	.97 3/4	1.04 1/2
1964-65	1.10 3/4	1.10 7/8	1.11 1/2
1965-66	1.20	1.19 3/8	1.13 5/8
1966-67	1.22 5/8	1.28 1/8	1.25 7/8
1967-68	1.09 5/8	1.13 1/8	1.14 1/8
1968-69	1.10 1/4	1.12 1/8	1.07 1/8
1969-70	1.19 1/8	1.18 3/4	1.18 7/8
1970-71	1.36 1/2	1.32 1/2	1.27 1/4
1971-72	1.07 5/8	1.04 1/8	1.05 1/8
1972-73	1.93 1/8	2.00 1/4	1.94 1/8
Average	1.22	1.22 1/2	1.22 3/8
Standard deviation	.255	.276	.256

Table 7f. Net returns employing the exponential smoothing strategy using a .03 smoothing constant

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	2	7	4	3	3	2
Maximum investment in margin	$256.25	$256.25	$250.00	$293.75	$450.00	$300.00
Earnings (losses) from futures (July option)	(131.25)	(125.00)	62.50	(62.50)	675.00	650.00
Commissions	44.00	154.00	88.00	66.00	66.00	44.00
Interest expense (income)	.86	6.27	4.06	4.81	4.91	(3.10)
Total earnings (losses) from the strategy	(176.11)	(285.27)	(29.56)	(133.31)	604.09	609.10
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.11	.97 3/4	1.10 7/8	1.19 3/8	1.28 1/8	1.13 1/8

Table 7f. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	2	1	2	5	2
Maximum investment in margin	$356.25	$300.00	$562.50	$331.25	$650.00
Earnings (losses) from futures (July option)	(18.75)	68.75	237.50	(62.50)	(475.00)
Commissions	44.00	30.00	60.00	150.00	60.00
Interest	6.14	3.91	5.34	5.92	4.08
Total earnings (losses) from the strategy	(68.89)	34.84	171.16	(218.42)	(539.08)
Cash price on or near 7/15	1.13 1/2	1.18	1.29	1.08 1/2	2.11
Net return from the strategy (rounded)	1.12 1/8	1.18 3/4	1.32 1/2	1.04 1/8	2.00 1/4

Trailing stop

The trailing stop strategy, after some modifications, generated some highly profitable results. The strategy was tested initially using the closes. The trailing stops were determined from the close of the market on the previous day. Trade execution took place on the close if the market touched to stop. The modifications which enhanced the results were to change the calculations of the stops. The stop-sell was derived by making subtractions from the previous day's high. The stop-loss is figured from the low and all transactions take place at the indicated stops.

An examination of the trailing stop strategy using the closes discloses that in 6 of the 11 crop years there were no transactions. There was only one trade in three of the remaining five seasons. The 1972-73 crop year had six market entries and exits. Three of the five seasons produced profits with two crop years of losses. During 1972-73 the loss exceeded 35 cents. Profits did not exceed 15 cents for the season.

The maximum investment required was $1,125.00 for margin and this was for 1972-73. The least amount of margin needed totaled $275.00. The commission summed to $180.00 during the last crop year. Interest expense ranged from $2.42 to $11.44 per crop year.

Moving to the trailing stop strategy employing the highs and lows a somewhat improved situation is found. The average return for the entire period was $1.27 3/8 with a standard deviation of $.439. The mean of the previous strategy was $1.20 3/4 with a standard deviation of $.192. The modified plan did not require a trade in 5 of the 11 crop years. Four of

Table 8a. Net returns from trailing stop strategy (using the closes) 8¼¢ - 10¼¢

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	0	0	0	0	1	1
Maximum investment in margin	0	0	0	0	$631.25	$275.00
Earnings (losses) from futures (July option)	0	0	0	0	743.75	418.75
Commissions	0	0	0	0	22.00	22.00
Interest expense	0	0	0	0	8.54	2.42
Total earnings (losses) from the strategy	0	0	0	0	713.21	394.33
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.30 1/4	1.08 7/8

Table 8a. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	0	0	2	1	6
Maximum investment in margin	0	0	$456.25	$512.50	$1,125.00
Earnings (losses) from futures (July option)	0	0	93.75	(162.50)	(1,762.50)
Commissions	0	0	60.00	30.00	180.00
Interest expense	0	0	3.37	2.14	11.44
Total earnings (losses) from the strategy	0	0	30.48	(194.64)	(1,953.94)
Cash price on or near 7/15	1.13 1/2	1.18	1.29	1.08 1/2	2.11
Net return from the strategy (rounded)	1.13 1/2	1.18	1.29 5/8	1.04 5/8	1.71 7/8

the six remaining seasons had one trade. The system generated eight trades in 1972-73. There was only one loss produced which was $.08 3/8 during the 1965-66 season. The remainder created net returns ranging from 5/7¢ to 46 1/2¢. The largest gain came in the 1972-73 season.

This strategy required a maximum investment of $1,000.00 for margin. The least amount needed was $275.00. The maximum investment in margin was less than $650.00 five of the six crop years. The interest expense was minimal, never rising above $5.59 for any one year. Commissions ranged from $22.00 to $240.00 with the latter figure occurring during the 1972-73 season.

Comparing the original plan to the modification, one discovers that by using the first strategy there were fewer market entries. There were no transactions in the 1965-66 crop year and two fewer in 1972-73. The first plan required a greater requirement of margin. More money was spent on commissions under the modified strategy. However, interest expense was nearly $10.00 less than the plan employing the closes. There were more profitable years with gains being larger using the modification. The loss was not as large as the dramatic loss of the 1972-73 season incurred in the original plan. The modification was a highly beneficial improvement.

Further changes were incorporated into the modified trailing stop strategy. In nearly half of the crop years in the previous two trailing stop strategies there was no market entry. Prices during these time periods covered a very narrow range. The trailing stops were reduced from eight and one-fourth cents to three cents and five cents to investigate their potential. These two new trailing stops were tested throughout the designated time period.

The outcome of the five cents trailing stop still resulted in no market entry during 1962-63. The rest of the crop years had at least one trade. The crop year 1966-67 had three transactions and 1968-71 indicated two each. Profitable outnumbered losing years by two. The beneficial years ranged from $.01 1/8 to $.67 1/2 in net returns. The losses fell from $.01 7/8 to $.08 1/2. Maximum investment reached $1,000.00 and was a low $250.00 for two crop years. Commissions topped at $510.00 in 1972-73. Interest varied from income of $.63 up to expenses of $11.36. Three crop years needed less than $.40 for interest cost.

Surveying the three cent trailing stop one observes that a transaction took place every crop year. Only one trade was executed three of the eleven crop years. During 1966-67 and 1970-71, there were six market entries. Losing seasons numbered five while the profitable ones hit seven. One crop year provided almost no return from the futures operation. Profits were spread from $.11 1/2 to $.27 1/4. Losses ran from $.00 3/8 to $.05. Peak investment in margin for the entire period was $1,000.00. The least required was $300.00. Commissions ranged from $22.00 to $750.00. Interest was always an expense. The maximum was $12.69. Four of the eleven crops fell below $3.50 for interest cost.

There are more transactions with the three cent stop than with the five cent trailing stop. Losses are greater and profits are smaller with the five cent model. The three cent trailing stop improved returns eight of the eleven seasons.

In order to determine the full limit of this strategy, higher levels of trailing stops were tested at five cent intervals up to fifty cents. The results of the four alternatives already discussed are included. The

Table 8b. Net returns from trailing stop strategy (using high, low and stop) 8¼¢ - 10¼¢

Crop year	62-63	63-64	64-65	65-66	66-67	67-68
Number of entries into the market	0	0	0	1	1	1
Maximum investment in margin	0	0	0	$587.50	$506.25	$275.00
Earnings (losses) from futures (July option)	0	0	0	(393.75)	593.75	56.25
Commissions	0	0	0	22.00	22.00	22.00
Interest expense	0	0	0	3.72	2.32	1.42
Total earnings (losses) from the strategy	0	0	0	(419.47)	569.43	32.83
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01
Net return from the strategy (rounded)	1.14 1/2	1.03 1/2	1.11 1/2	1.13 5/8	1.27 3/8	1.01 5/8

Table 8b. (continued)

Crop year	68-69	69-70	70-71	71-72	72-73
Number of entries into the market	0	0	2	1	8
Maximum investment in margin	0	0	$637.50	$300.00	$1,000.00
Earnings (losses) from futures (July option)	0	0	250.00	81.25	2,556.23
Commissions	0	0	60.00	30.00	240.00
Interest expense	0	0	5.59	.45	5.44
Total earnings (losses) from the strategy	0	0	84.41	50.80	2,310.79
Cash price on or near 7/15	1.13 1/2	1.18	1.29	1.08 1/2	2.11
Net return from the strategy (rounded)	1.13 1/2	1.18	1.30 5/8	1.09 1/2	2.57 1/4

Table 8c. Five cent trailing stop for 1962-69 (using highs and lows)

Crop year	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Number of entries into the market	0	1	1	1	3	1	2
Maximum investment in margin	0	$200.00	$275.00	$250.00	$468.75	$250.00	$456.25
Earnings (losses) from futures (July option)	0	(181.25)	81.25	(68.75)	787.50	400.00	(268.75)
Commissions	0	22.00	22.00	22.00	66.00	22.00	44.00
Interest expense	0	.34	.26	4.65	4.89	+.63	6.26
Total earnings (losses) from the strategy	0	(203.59)	58.99	(94.40)	716.61	378.63	(319.01)
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01	1.13 1/2
Net return from strategy (rounded)	1.14 1/2	.99 3/8	1.12 5/8	1.20 1/8	1.30 3/8	1.08 1/2	1.07 1/8

Table 8c. (continued)

Crop year	69-70	70-71	71-72	72-73
Number of entries into the market	2	2	1	1
Maximum investment in margin	$481.25	$587.50	$525.00	$1,000.00
Earnings (losses) from futures (July option)	(356.24)	862.50	112.50	1,881.25
Commissions	60.00	60.00	30.00	510.00
Interest expense	6.31	6.28	9.70	11.36
Total earnings (losses) from the strategy	(422.55)	796.22	72.80	1,359.89
Cash price on or near 7/15	1.18	1.29	1.08 1/2	2.11
Net return from strategy (rounded)	1.09 1/2	1.44 7/8	1.10	2.38 1/4

Table 8d. Three cents trailing stop for 1962-69 (using highs and lows)

Crop year	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Number of entries into the market	1	2	1	4	6	1	3
Maximum investment in margin	$318.75	$325.00	$200.00	$337.50	$493.75	$343.75	$350.00
Earnings (losses) from futures (July option)	(112.50)	(50.00)	118.75	(156.25)	1,175.00	600.00	75.00
Commission	22.00	44.00	22.00	88.00	132.00	22.00	66.00
Interest expense	3.36	9.33	.95	2.95	5.13	2.75	8.14
Total earnings (losses) from the strategy	(137.86)	(103.33)	95.80	(247.20)	1,037.87	575.25	.86
Cash price on or near 7/15	1.14 1/2	1.03 1/2	1.11 1/2	1.22	1.16	1.01	1.13 1/2
Net return from strategy (rounded)	1.11 3/4	1.01 1/2	1.13 3/8	1.17	1.36 3/4	1.12 1/2	1.13 1/2

Table 8d. (continued)

Crop year	69-70	70-71	71-72	72-73
Number of entries into the market	2	6	2	25
Maximum investment in margin	$300.00	$518.75	$387.50	$1,000.00
Earnings (losses) from futures (July option)	43.75	912.50	256.25	4,137.50
Commission	60.00	180.00	60.00	750.00
Interest expense	3.84	8.86	6.88	12.69
Total earnings (losses) from the strategy	(20.09)	723.64	189.37	3,374.81
Cash price on or near 7/15	1.18	1.29	1.08 1/2	2.11
Net return from strategy (rounded)	1.17 5/8	1.43 1/2	1.12 1/4	2.78 1/2

Table 8e. Net returns from various trailing stops (rounded)

Crop year	Trailing stop						
	.03	.05	.0825[a]	.0825	.15	.20	.25
1962-63	1.11 3/4	1.14 1/2	1.14 1/2	1.14 1/2	1.14 1/2	1.14 1/2	1.14 1/2
1963-64	1.01 1/2	.99 3/8	1.03 1/2	1.03 1/2	1.03 1/2	1.03 1/2	1.03 1/2
1964-65	1.13 3/8	1.12 5/8	1.11 1/2	1.11 1/2	1.11 1/2	1.11 1/2	1.11 1/2
1965-66	1.17	1.20 1/8	1.22	1.13 5/8	1.22	1.22	1.22
1966-67	1.36 3/4	1.30 3/8	1.30 1/4	1.27 3/8	1.18 1/8	1.21 3/8	1.16
1967-68	1.12 1/2	1.08 1/2	1.08 7/8	1.01 5/8	.88 1/8	1.01	1.01
1968-69	1.13 1/2	1.07 1/8	1.13 1/2	1.13 1/2	1.13 1/2	1.13 1/2	1.13 1/2
1969-70	1.17 5/8	1.09 1/2	1.18	1.18	1.18	1.18	1.18
1970-71	1.43 1/2	1.44 7/8	1.29 5/8	1.30 5/8	1.04 7/8	1.09	1.29
1971-72	1.12 1/4	1.10	1.04 5/8	1.08 1/2	1.11 1/8	1.09 1/2	1.08 1/2
1972-73	2.78 1/2	2.38 1/4	1.71 7/8	2.57 1/4	2.39 3/4	2.39 5/8	2.45 1/4

[a]The closes were employed rather than the highs and lows.

Table 8e. (continued)

Crop year	Trailing stop				
	.30	.35	.40	.45	.50
1962-63	1.14 1/2	1.14 1/2	1.14 1/2	1.14 1/2	1.14 1/2
1963-64	1.03 1/2	1.03 1/2	1.03 1/2	1.03 1/2	1.03 1/2
1964-65	1.11 1/2	1.11 1/2	1.11 1/2	1.11 1/2	1.11 1/2
1965-66	1.22	1.22	1.22	1.22	1.22
1966-67	1.16	1.16	1.16	1.16	1.16
1967-68	1.01	1.01	1.01	1.01	1.01
1968-69	1.13 1/2	1.13 1/2	1.13 1/2	1.13 1/2	1.13 1/2
1969-70	1.18	1.18	1.18	1.18	1.18
1970-71	1.29	1.29	1.29	1.29	1.29
1971-72	1.08 1/2	1.08 1/2	1.08 1/2	1.08 1/2	1.08 1/2
1972-73	2.45 1/8	2.45 1/8	2.45 1/8	2.45 1/8	2.45 1/8

Table 8f. Mean net prices and standard deviations from trailing stop (rounded)

Trailing stop	Mean net price	Standard deviation
.03	1.13 1/8	.500
.05	1.26 7/8	.390
.08 1/4 - 10 1/4[a]	1.20 3/4	.192
.08 1/4 - 10 1/4	1.27 3/8	.439
.15	1.22 1/4	.400
.20	1.23 7/8	.390
.25	1.25 3/4	.404
.30 - .50	1.25 3/4	.404

[a]Using the closes to calculate the stops.

Table 8g. Mean net prices for the trailing stop strategy ranked

Value of trailing stop	Mean net price
.03	1.32 1/8
.08 1/4 - 10 1/4	1.27 3/8
.05	1.26 7/8
.25	1.25 3/4
.30 - .50	1.25 3/4
.20	1.23 7/8
.08 1/4 - 10 1/4[a]	1.20 3/4

[a]Using the closes to calculate the stops.

net outcome of each is displayed in Table 8e. The mean net price and standard deviation of all the trailing stop strategies are shown in Table 8f.

Reviewing the net outcomes of each trailing stop, one finds that after 30 cents is reached there is no change. The trailing stop was only effective for 1972-73. The other crop years had no trades. One can detect other crop years where the trailing stop was ineffective. This strategy worked remarkably well at all levels for the 1972-73 crop year. There was one exception however. When the closes were used as the foundation for calculation there was a loss. This was the only marketing plan that accrued profits for the last crop year of the study.

Visually surveying the mean net prices, one observes that all forms of this strategy have a large standard deviation as compared to the other marketing plans. The net average price is substantially higher. As the trailing stop increases in value the average price declines and levels off. There are fewer market entries when the trailing stop approaches 50 cents. This would require the decision maker to carry a greater share of the price risk. The strategy catches major price swings with a larger stop-loss but they must be gigantic moves. The .08 1/4 - $.10 1/4 trailing stop provides more price protection than those with larger values.

Table 8g ranks the mean net prices from largest to smallest. To solidify this ranking the same procedure is employed as used for the ordering of the naive strategies. One must first run an F-test to determine whether or not there is a significant difference among the means. The test demonstrated there were no significant differences among the means. In other words, they are all considered to be equal. For purposes of

comparison the two strategies with the highest mean net prices will be selected. These are the three cent and the 8 1/4 - 10 1/4 cent trailing

Iowa Farm Outlook

Checking the outcomes of the advice of professional agricultural economists has to be done in an arbitrary fashion. When "late spring - early summer" selling recommendations are made, one has to arbitrarily decide on the exact selling date. The midpoint of the advised time period was chosen to market the corn. If Outlook Publications (7,8,27) indicated that when a certain price level was attained one should sell then a sale was made if this price was reached. Perhaps the next issue would recommend selling within a different price range. However, if the first advised price was reached prior to the revision, the corn was sold. The outcomes of hedging recommendations are presented in Table 9. The results were based on a 10 percent stop-loss. The footnotes indicate the realized net price if one remained with his hedge until the suggested cash selling date. Remaining with a hedge throughout all types of market situations is a philosophy that many prescribe.

The 10 percent stop-loss generated a mean net price of $1.23 3/4 with a standard deviation of $.217. Ignoring the 10 percent rule the mean net price was $1.17 with a standard deviation of $.120. This suggests that constantly monitoring a hedged position will improve returns. The Outlook results will be analyzed further in comparison to the outcomes of the other strategies.

Table 9. Marketing recommendations from Iowa Farm Outlook (7,8,27)

Crop year	Cash sale date	Cash price	Hedging date(s)	Option	Return from hedge(s)	Net return
1962-63	3/15/63	$1.07				$1.07
1963-64	5/15/64	$1.10 1/2				$1.10 1/2
1964-65	4/15/65	$1.18				$1.18
1965-66	5/2/66	$1.14 1/2				$1.14 1/2
1966-67	1/9/67	$1.26				$1.26
1967-68	5/15/68	$1.07 1/2				$1.07 1/2
1968-69	5/29/69	$1.15				$1.15
1969-70	6/25/70	$1.20				$1.20
1970-71	8/25/71	$1.34 1/2	6/1/70[a] 8/17/70	March July	(12 5/8¢) (8¢)	$1.27 1/4[b]
1971-72	2/15/72	$1.04 1/2	3/18/71	March	(27 1/2¢)	$1.31
1972-73	6/25/73	$2.00	4/3/72 8/15/72[a]	March July	(1¢) (13 3/4¢)	$1.84 3/4[c]

[a]Ten percent stop-loss employed.

[b]Remaining with the advised hedge in March corn the net price was $1.40 1/8 by liquidating the futures on the date of the cash sale.

[c]Remaining with the advised hedge in July corn the net price was $.97 3/4 by liquidating the futures on the date of cash sale.

Mean Net Price

Each strategy must be put in proper perspective with the others. One way to do this is to simply review the mean net prices and standard deviations. The ideal strategy is one with a high mean net price and a low standard deviation. The drastic jump in prices during 1972-73 causes this method to have less value than one would ordinarily expect. The last crop year studied demolished the idea of positive returns from most of the strategies. The trailing stop marketing plans were the only ones to generate a return in the black. The mean net prices to this point have not considered the interest cost incurred in holding an inventory where it applies. All strategies have not been adjusted for interest charges in Table 10a. Table 10b designates the interest cost incurred from storing grain for the various strategies. Table 10c displays the adjusted mean net prices ranked and the corresponding standard deviations of each marketing plan. There was a substantial reduction due to interest charges for some of the strategies.

There is not one strategy which fits the perfect model that was mentioned previously. In general, as the mean net price rose so did the standard deviation. The trailing stop marketing systems were the only ones which surpassed the marketing actions suggested by Outlook with a stop-loss. A number of the alternatives exceeded the Outlook returns without a stop-loss.

The trailing stop strategies generated the greatest return for the period investigated. The trailing stop and the modified basis plans each had the same number of crop years showing a return over selling on July 15.

Pointing out some other items in Table 10a, random selling may not be an attractive possibility for some producers because of a high standard deviation. Harvest selling falls into the same category with random selling when compared to the planting hedges. The decision maker would generally be advised to choose a strategy with a smaller range of possible outcomes. Examining the wide dispersion of the returns, it is difficult to select one best strategy. The first step in the statistical analysis of the means is to ascertain if there is a difference among the means which is greater than a chance happening. An analysis of variance test indicates that the differences among the means could occur as a matter of chance five percent or more of the time. However, as indicated earlier, the F-test applies to random data or analysis of samples drawn from normally distributed populations and may not always detect differences in economic data. Perhaps no statistical test is needed nor appropriate for data of this nature. It is a point which frequently plagues economists. Profits and losses in grain production are measured in dollars and cents and the best plan is the one which gives the highest value. Success is often determined by a few units per bushel. Statistical analysis is not performed on the records of those who went broke and those who were successful to determine if there was a significant difference in the outcomes. A system which gives a higher average price consistently has merit even though the difference may be small.

The planting hedges and harvest selling should be lower in the decision maker's scale of priorities of buying and selling corn. The strategies using the basis fall on one of the lower rungs of the ladder towards the most profit.

Table 10a. Mean net prices for all strategies with inventory interest expense excluded

Strategy	Mean net price
1. Harvest selling	$1.07 3/8
2. Hedge at planting with stop-loss	1.08 7/8
3. Hedge at planting without stop-loss	1.07 1/2
4. Harvest hedge with stop-loss	1.22 7/8
5. Harvest hedge without the stop-loss	1.14 3/4
6. Random selling	1.19 3/8
7. Basis change	1.13 3/4
8. Modified basis change	1.16 1/8
9. Three point reversal	1.19 1/4
10. Simple moving average	1.17 3/4
11. Major price trend directional indicator	1.22 3/8
12. Exponential smoothing	1.22 1/2
13. Trailing stop	1.32 1/8
14. Trailing stop with highs and lows	1.27 3/8
15. Outlook with the stop-loss	1.23 3/4
16. Outlook without the stop-loss	1.17

Table 10b. Interest expense per bushel for carrying inventory

Crop year	Cost from 12/1 to 7/15	Cost for those who sell randomly	Cost for those who sell by using Outlook
1962-63	$.04 3/4	$.04 1/8	$.02 7/8
1963-64	.05	.03 3/8	.04 1/4
1964-65	.05 3/8	.02 1/2	.04
1965-66	.05 1/4	.04 3/8	.04 1/8
1966-67	.06 1/8	.08 5/8	.00 7/8
1967-68	.04 3/4	.04 3/8	.04 1/8
1968-69	.05 1/8	.06 3/8	.04 1/2
1969-70	.05 1/8	.02	.04 3/4
1970-71	.06 3/8	.03 3/8	.08 1/2
1971-72	.04 7/8	-	.02 1/4
1972-73	.06 3/8	.09 3/4	.05 7/8
Average	.05 3/8	.04 3/8	.04 1/4

Table 10c. Ranking of strategies after deducting interest costs on inventories

Ranking	Strategy	Mean net price	Standard deviation
1	Three cent trailing stop	$1.26 3/4	$.500
2	Trailing stop with the highs and lows	1.22	.439
3	Outlook with the stop-loss	1.19 1/2	.217
4	Harvest hedge with the stop-loss	1.17 1/2	.300
5	Exponential smoothing (C = .03)	1.17 1/8	.276
6	MPTDI	1.17	.256
7	Random selling	1.15 1/4	.308
8	Three point reversal	1.13 7/8	.227
9	Outlook without the stop-loss	1.12 3/4	.217
10	Simple moving average	1.12 3/8	.194
11	Modified basis change	1.10 3/4	.093
12	Harvest hedge without the stop-loss	1.09 3/8	.127
13	Hedge at planting with the stop-loss	1.08 7/8	.064
14	Basis change	1.08 3/8	.097
15	Hedge at planting without the stop-loss	1.07 1/2	.066
16	Harvest selling	1.07 3/8	.128

The 1972-73 crop year lowered the profit potential of all of the strategies except for the trailing stops, planting hedges and harvest selling. The trailing stop marketing methods demonstrated a remarkable ability to cope with the volatility of the market. The 1972-73 crop year was the beginning of another era. An analysis of the outcomes of the crop years prior to 1972-73 may offer further insight into the better ways to sell corn. A t-test was conducted on those strategies with stop-losses to determine significance. The results indicated there was none.

The F-value, for differences among the means, derived for this time period was not significant at the five percent level, however, the standard deviations were reduced by more than one half. This confirms the previously stated conclusion for the 1972-73 crop year. The means are presented in ranked form Table 10d. The trailing stop systems did not fare as well as previously. The professional economist's recommendations moved into the top two places. This may indicate the quandry in which economists found themselves during 1972-73. The harvest hedges fell into the bottom two slots. The weighted moving average (MPTDI) jumped to third place.

To summarize the outcomes of this section, when relative tranquility persists in the market there is a much different ordering of the marketing alternatives. The harvest hedges sank in profitability and were eliminated as a possibility. It appears that there is merit to following professional advice. The selected strategies, for the most part, outperformed those conducted in practice.

Table 10d. Ranked mean net prices for all strategies excluding the 1972-73 crop year (rounded)

Ranking	Strategy	Mean net price
1	Outlook without the stop-loss	1.14 7/8
2	Outlook with the stop-loss	1.13 5/8
3	MPTDI	1.12 3/4
4	Three cent trailing stop	1.12 1/4
5	Modified basis change	1.11 1/8
6	Exponential smoothing (C = .03)	1.09 1/2
7	Trailing stop with the high and lows using 8¼ - 10¼ cents	1.09 1/8
8	Basis change	1.08 1/2
9	Planting hedge with the stop-loss	1.08 3/8
10	Three point reversal	1.07 1/2
11	Planting hedge without the stop-loss	1.07 3/8
12	Simple moving average	1.06 7/8
13	Random selling	1.06 5/8
14	Harvest selling	1.05 3/8
15	Harvest hedge without the stop-loss	1.03 1/8
16	Harvest hedge with the stop-loss	1.03 1/8

Net storage income comparison

Examining the storage income possibilities from December 1 to July 15 provides some results which, perhaps, are more meaningful to the warehouseman than the producer. Two controls are established for this comparison. One of the standards is the storage payments made by Agricultural Stabilization and Conservation Service. This is the bare minimum one could receive for storing corn without taking much risk. The other standard is the normal cash price change throughout the period. If one were to simply buy corn at harvest and sell at mid-summer, the returns are what he would receive from his endeavors. These costs would be equivalent each year and would not distort the relation of any one of the strategies to the others. The net outcomes are best thought of as returns to storage. The net price on July 15 minus the December 1 cash price determines the net storage income for the various hedging strategies. Of course, the planting hedges were eliminated as well as random selling and the harvest sale. The outcomes for each individual crop year are presented in Table 11.

Reviewing these returns to storage, the three cent trailing stop was the most beneficial alternative three of the crop years during the investigated period. The harvest hedges and the Agricultural Stabilization and Conservation Service storage fees won twice. The unmodified basis change model and the exponential smoothing plan were never the front runners for any of the crop years. The harvest hedge with a stop-loss, the trailing stop using the session highs and lows, always returned a higher price on July 15 than on December 1. Of course, the ASCS payments always put the outcome in the black.

Turning to Table 12, the mean net storages incomes ranked and the standard deviations are displayed. The harvest hedge without a stop-loss was the last place possibility for storage income. The trailing stop strategies decisively exceeded the third place marketing plan. The widest separation was between the second and third place methods. The high mean net storage income systems carried a high standard deviation. As the average declined so did the standard deviation. The exponential smoothing strategy fell contrary to this trend. If the decision maker is a risk averter, he would eliminate this plan. The ASCS storage payments had the lowest standard deviation. The elevator operator would not select the two last place strategies when the tenth place possibility is readily available. Likewise on the top side, those marketing systems which exceed the normal cash price change should receive strong consideration. The cash price change is the simplest marketing technique in practice. Merchandisers desire profits in excess of the normal price change; otherwise the extra mental turmoil of contending with the futures market is of no benefit.

To put more confidence in the numerical ranking in Table 12, the F-test is employed. At the five percent level, the data fail to indicate that there is any difference except by mere chance.

The visual ranking of the means describes as much as anything about the various mechanical strategies. The trailing stop plans tend to be more beneficial than the others. If one employs either of the basis strategies and the harvest hedge without a stop-loss he, perhaps, should reevaluate his manner of decision making.

Table 11. Net storage income (12/1 - 7/15)

Strategy \ Crop year	1962-63	63-64	64-65	65-66	66-67	67-68
1. ASCS storage payments	8 3/4¢	8 1/2¢	8 1/2¢	8 1/2¢	8 1/2¢	8 1/2¢
2. Cash price change	20¢	4¢	3¢	17 1/2¢	(7 1/2¢)	6¢
3. Harvest hedge with stop	7 1/8¢	8 1/4¢	3 5/8¢	4 1/8¢	17 1/4¢	18 3/4¢
4. Harvest hedge without stop	7 1/8¢	8 1/4¢	3 5/8¢	4 7/8¢	17 1/4¢	18 3/4¢
5. Basis change	13 3/4¢	5¢	4 5/8¢	4 3/8¢	16 1/8¢	14 1/4¢
6. Modified basis change with 1/2 standard deviation	20¢	4¢	3¢	17 1/2¢	6 1/2¢	12 3/8¢
7. Three point reversal	20¢	3¢	1¢	9 3/4¢	3 1/2¢	18 1/8¢
8. Simple moving average	17 1/2¢	2 3/8¢	1 3/4¢	8 3/8¢	(9 3/4¢)	14¢
9. MPTDI	16 1/2¢	3 3/8¢	2 3/4¢	16 1/8¢	2¢	14 1/8¢
10. Exponential smoothing	6 1/2¢	(1 3/4¢)	2 3/8¢	14 7/8¢	4 5/8¢	8 1/8¢
11. Three cent trailing stop	7 1/4¢	2¢	(1 1/8¢)	12 1/2¢	13 1/4¢	17 1/2¢
12. Trailing stop with high and low	20¢	4¢	3¢	9 1/8¢	3 7/8¢	6 5/8¢

Table 11. (continued)

Strategy	Crop year	1968-69	69-70	70-71	71-72	72-73
1.	ASCS storage payments	8 1/2¢	8 1/2¢	8 1/2¢	9 3/8¢	9 3/8¢
2.	Cash price change	12¢	16¢	1¢	11 1/2¢	84¢
3.	Harvest hedge with stop	7 1/4¢	7 3/4¢	10¢	10¢	68 3/4¢
4.	Harvest hedge without stop	7 1/4¢	7 3/4¢	10¢	10¢	(6 1/8¢)
5.	Basis change	7 3/8¢	17 3/8¢	11¢	10 1/2¢	(12 1/4¢)
6.	Modified basis change with 1/2 standard deviation	12¢	18¢	6 1/8¢	14 1/4¢	(15 7/8¢)
7.	Three point reversal	4¢	9¢	(7 5/8¢)	10 7/8¢	57 3/8¢
8.	Simple moving average	13 1/4¢	13 3/8¢	(2 5/8¢)	9 1/2¢	46 1/2¢
9.	MPTDI	8 3/8¢	24 7/8¢	(1 5/8¢)	11 1/8¢	68 1/4¢
10.	Exponential smoothing	10 5/8¢	16 3/4¢	4 1/2¢	7 1/8¢	73 1/4¢
11.	Three cent trailing stop	12¢	15 5/8¢	15 1/2¢	15 1/4¢	1.51 1/2¢
12.	Trailing stop with high and low	12¢	16¢	2 5/8¢	12 1/2¢	1.30 1/4¢

Table 12. Mean net storage income for each strategy ranked

Ranking	Strategy	Mean net price	Standard deviation
1	Three cent trailing stop	$.23 3/4	.428
2	Trailing stop with the highs and lows	.20	.370
3	Cash price change	.15 1/4	.242
4	Major price trend directional indicator	.15 1/8	.193
5	Harvest hedge with the stop-loss	.14 3/4	.185
6	Exponential smoothing (C = .03)	.13 3/8	.206
7	Three point reversal method	.11 3/4	.170
8	Simple moving average	.09 1/2	.143
9	Modified basis change	.08 7/8	.101
10	ASCS payments	.08 5/8	.004
11	Basis change	.08 3/8	.083
12	Harvest hedge without the stop-loss	.08 1/8	.070

SUMMARY AND CONCLUSIONS

It can be surmised that the basic hypothesis for the entire investigation was that the decision maker for any stock of grain should hedge if prices fall and reamin open on price increases. This hypothesis was exemplified by the mechanical hedging strategies. In turn, these were set against the marketing operations currently employed in practice. To further test the validity of the proposed mathematical marketing systems, the advice of professional agricultural economists was added. The producer is interested in the total net dollars. To complete the investigation returns to storage were also compared.

Summarizing some general aspects of the study, it was shown that quick surges in a bull or bear market are difficult to contend with. One needs to observe the market objectively to allow the price to fluctuate but yet continue in the established direction. However, the decision maker cannot be too far removed or he incurs a huge loss. Some of the proposed methods handled this price behavior characteristic better than others. The trailing stop and the modified basis strategy, with the exception of 1972-73 for the latter, were the ones which seem to cope with this situation the best.

For many of these mechanical hedging strategies, a hedge was still in effect on July 15. All of the proposed methods were confined to this time period. This may have limited some of the returns of the various strategies. It may have been advantageous to liquidate all stocks of grain at an earlier date or perhaps a later date.

There are several assumptions which should be discussed. The first is the eight percent interest rate. This will lower the returns part of the time and enhance it other times. More importantly, the assumption of always receiving the indicated price requires a fantastic broker. Few of these individuals are capable of executing at the exact price desired due to the volatility of the market. Execution is a key element for anyone participating in the futures market.

The final assumption is that the decision maker was restricted to one marketing technique throughout 1962-73. In reality, individuals selling corn switch marketing plans often. One crop year they adhere to one strategy and next they move to something else. There are few individuals who possess the foresight necessary to recognize the proper time to substitute one marketing technique for another. Reevaluating the market constantly for the strategy best adapted to cope with the price fluctuation should be the decision maker's major interest.

This study demonstrates what strategies have worked the best for the entire period. It encompassed time periods of enormous price swings and relative serenity. The ideal technique would be to select one for the different types of markets. What would be used as the decision making variable? If price movements were chosen, how many cents and over what period of time would one make the decision to alter the strategy. Hindsight is perfect but who knows what the future will dictate. The trailing stop strategies seemed to contend with the entire 1962-73 period the best. When 1972-73 was excluded it fell back but this strategy allows price to vary more than many of the other plans before entering the market. This

marketing plan leaves a certain amount of the responsibility of price risk on the decision maker. The risk taker can, perhaps, capture six cents more by selling his cash corn properly. This system does attempt to keep the producer from looking foolish for having sold his crop too soon. What are the benefits of the second place trailing stop to a producer of 160 acres of corn, as compared to the harvest hedge with the stop-loss. Assume there is a one hundred bushel yield. The total production would be 16,000 bushels. The additional net profits would be $720.00. For an elevator that handles 1,000,000 bushels of corn, the increased net returns would be $45,000. Neither of these figures include the profit already derived from handling and are in addition to that normally earned.. These marketing techniques require little judgment on behalf of the decision maker. An astute individual with a good "feel" of the corn market could perhaps generate further positive returns due to the confinements of the mechanical hedging strategies.

This investigation points out the benefits of constantly monitoring a hedge. Having stop-losses strategically placed can mean a substantial savings. The crude and arbitrary stop-loss of ten percent illustrated some positive benefits. The rule-of-thumb for profitable speculation applies to hedging as well as speculating. It is that a speculator should let his profits run and cut his losses short. This investigation lends support to the statement as being a worthwhile bit of advice. It also provides strong evidence that losses on a hedge should limited. If the negative returns hit the limit, the hedge should be liquidated. There is nothing sacred about maintaining a hedge. Constant hedge surveillance with a willingness

to make several hedges during one crop year should be the general model for hedging theory.

The results indicate other beneficial outcomes for the producer and merchandiser. Hedging advisory services can be meaningful financially to involved individuals. Professional recommendations as well as hedges generated by the mechanical strategies could guide the inventory holder towards the most beneficial alternative.

Producers and merchandisers are constantly searching for methods to increase profits and to reduce price risk. The methods studied in this investigation have considerable potential for increasing the profits of producers and grain merchandising.firms.

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APPENDIX

Table A1. Changes in limit moves, commissions and hedging margins (28) for corn futures on the Chicago Board of Trade

Limits

a) The daily limit on price movement on a 5000 bu. contract of corn was 8¢ from 1/1/62 to 5/31/73.

b) The limit was increased to 10¢ on 6/1/73.

Commissions on corn

a) In 1961, a 5000 bushel contract (1) could be traded for a $9.00 commission if you were a member and the price was $.99 7/8 or below. It was $18.00 for non-members. When the selling price was between $1.00 and $2.24 7/8 (2), it was $22.00 for non-members and $11.00 for members. When corn was selling for $2.25 or more, (3) the commission rose to $12.00 for members and $24.00 for non-members.

b) From 1962-1970, it cost $22.00 for non-members and $11.00 for members.

c) From 1970-1973, the commission increased to $30.00 for non-members and $15.00 for members.

Margin Requirements for corn hedgers

a) From 1962 to 1965, the margin requirement was fixed at $200 per contract.

b) From 1/1/66 to 9/20/66, the margin was to be maintained at $250.00.

c) From 9/21/66 to 2/15/67, the margin jumped to $400.00.

d) From 2/16/67 to 1/12/68, the margin declined to $300.00 per contract.

e) From 1/13/68 to 8/18/70, the margin dropped to $250.00.

f) From 8/19/70 to 3/4/71, it doubled to $500.00.

g) From 3/5/71 to 9/22/71, it was $400.00.

h) From 9/23/71 to 9/25/72, the margin leveled off at $300.00.

i) From 9/26/72 to 12/6/72, the margin rose to $400.00.

Table A1. (continued)

j) From 12/7/72 to 3/27/73, it climbed to $500.00.

k) From 3/28/73 to 5/29/73, it fell to $400 for each contract.

l) From 5/30/73 to 5/31/73, it stepped up to $500.00.

m) From 6/1/73 to 6/4/73, the margin reached $750.00.

n) From 6/5/73 to 10/18/73, the margin peaked at $1000 per corn contract.

o) From 10/19/73 to 12/31/73, it decreased to $750.00.

Table A2. The average weekly central Iowa basis and standard deviations for July corn from 1962-74 in dollars

Week no.	Average basis	Average standard deviation
1[a]	.26432	.08709
2	.27166	.09595
3	.28094	.09819
4	.28241	.07070
5	.28417	.06107
6	.27725	.06622
7	.27824	.06289
8	.27542	.05609
9	.27365	.06732
10	.25494	.05515
11	.23634	.05823
12	.23849	.06131
13	.21541	.05299
14	.17164	.03603
15	.19370	.03589
16	.18714	.03081
17	.18109	.03433
18	.17913	.03333
19	.18121	.03402
20	.17737	.03201

[a]Week no. 1 begins on October 1.

Table A2. (continued)

Week no.	Average basis	Average standard deviation
21	.18309	.03959
22	.19028	.03324
23	.18874	.04218
24	.18504	.04336
25	.17984	.04229
26	.17529	.04196
27	.17266	.04154
28	.17032	.04053
29	.16401	.03895
30	.15729	.03957
31	.15388	.03776
32	.15973	.02839
33	.14595	.03432
34	.14358	.04747
35	.14272	.03489
36	.15459	.05297
37	.15360	.05377
38	.15320	.05252
39	.16133	.07141
40	.16233	.07389
41	.16903	.07585
42[b]	.16903	.07585

[b]Week no. 42 ends on July 19.

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